NATIONAL PETROLEUM NEWS

TECHNOLOGY DEPT:

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DETROIT

NEW WARTIME EDITION
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BULLETINS

HOUSE GROUP URGES HIKE

WASHINGTON—Higher crude prices were recommended in interim report issued Oct. 5 by House naval affairs oil subcommittee, headed by Rep. Rivers, S. C. Conflicts between OPA and PAW over necessity for crude price increase only emphasize the desirability of having just one agency handle all problems of the petroleum industry, the report said. Committee recommended construction of a 12-in. pipeline from Texas to Chesapeake Bay area.

° ° °

BILL WOULD HIKE CRUDE

WASHINGTON—Sen. Thomas, Okla., introduced a bill Oct. 5 to increase crude prices throughout the U. S. by at least 35c per bbl. and products prices "sufficiently to compensate for additional price paid for crude."

° ° °

PLANTS GET LABOR PRIORITY

WASHINGTON—WPB Vice-Chairman C. E. Wilson informed Manpower Commissioner McNutt Oct. 5 that 100-octane aviation gasoline plants country-wide are to be considered on a par with aircraft, escort vessels, synthetic rubber plants, in providing common and skilled construction labor.

High priority status requested by Wilson provides for diversion of labor from less urgent war production programs if necessary.

° ° °

TO USE MORE BRITISH OIL

WASHINGTON — President Roosevelt told his press conference late Oct. 5 that opening of Mediterranean to United Nations' shipping has made possible rearrangement of tanker shipments, with consequent alleviation of disproportionate drain that has been placed on U.S. reserves since outbreak of the war. He said that a larger share of oil will be required of the British as a result.

News Highlights of the Week

United States Promotes Foreign Oil

Criticism that U.S. is supplying disproportionate share of oil for United Nations' war effort forced into open some of PAW's long-range world oil programming. Ickes, at meeting with West Coast congressmen, reveals magnitude of foreign oil plans; President Roosevelt, at press conference, says more British oil will be used now that Mediterranean is open. P. 3.

Showdown on Crude Oil Prices Ready

Some 40 independent producers jam Washington seeking action; aroused Congressmen hold caucus to discuss legislation forcing crude price ceilings higher. Stabilizer Vinson now has all the "evidence"; Congressmen and others can look to White House for explanation of delays in making a decision. P. 10.

Gasoline Squeeze Only a Prelude

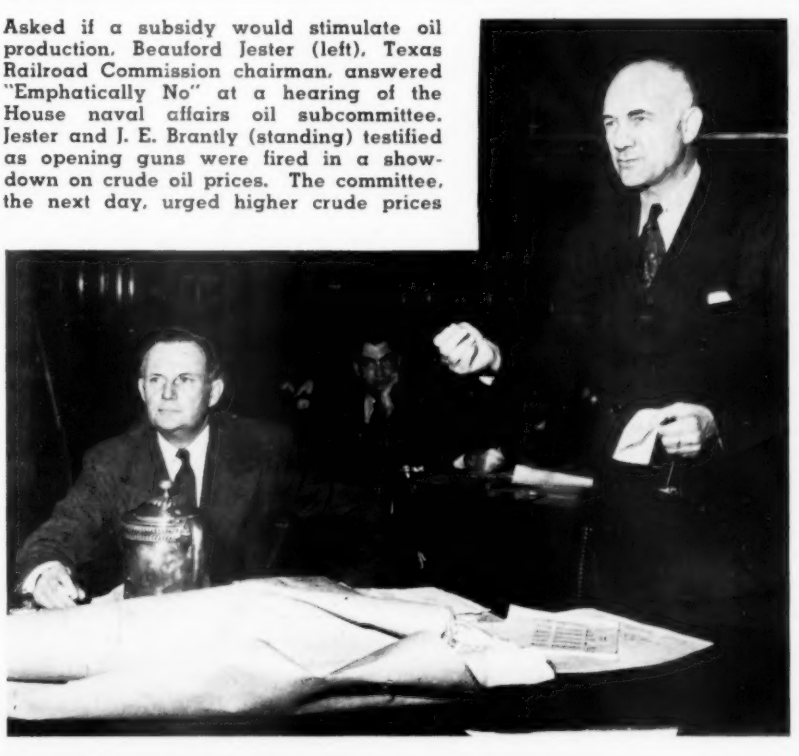
Districts 4 and 5 next on list following cuts in Districts 2 and 3 "B" and "C" gasoline allotments. After that, greater nationwide curtailments are likely, accompanied by a cut in quality of automotive gasoline for civilians. P. 12.

PAW Cuts District 5 'Gas' Quality

West coast refiners directed to increase yields of military aviation and 80-octane all-purpose gasolines and to cut yields of premium grade automotive gasoline for civilian use. Controls over distillation range established. P. 20.

Rules Suspensions Unconstitutional

Texas Federal Judge attacks OPA "kangaroo" court procedure in opinion halting shutdown ordered by OPA against Dallas station chain; regional OPA officials map fight. P. 5.



Asked if a subsidy would stimulate oil production, Beauford Jester (left), Texas Railroad Commission chairman, answered "Emphatically No" at a hearing of the House naval affairs oil subcommittee. Jester and J. E. Brantly (standing) testified as opening guns were fired in a showdown on crude oil prices. The committee, the next day, urged higher crude prices

REFINERY MANAGEMENT AND PETROLEUM CHEMICAL TECHNOLOGY EDITION—In 2 Sections, Section 1

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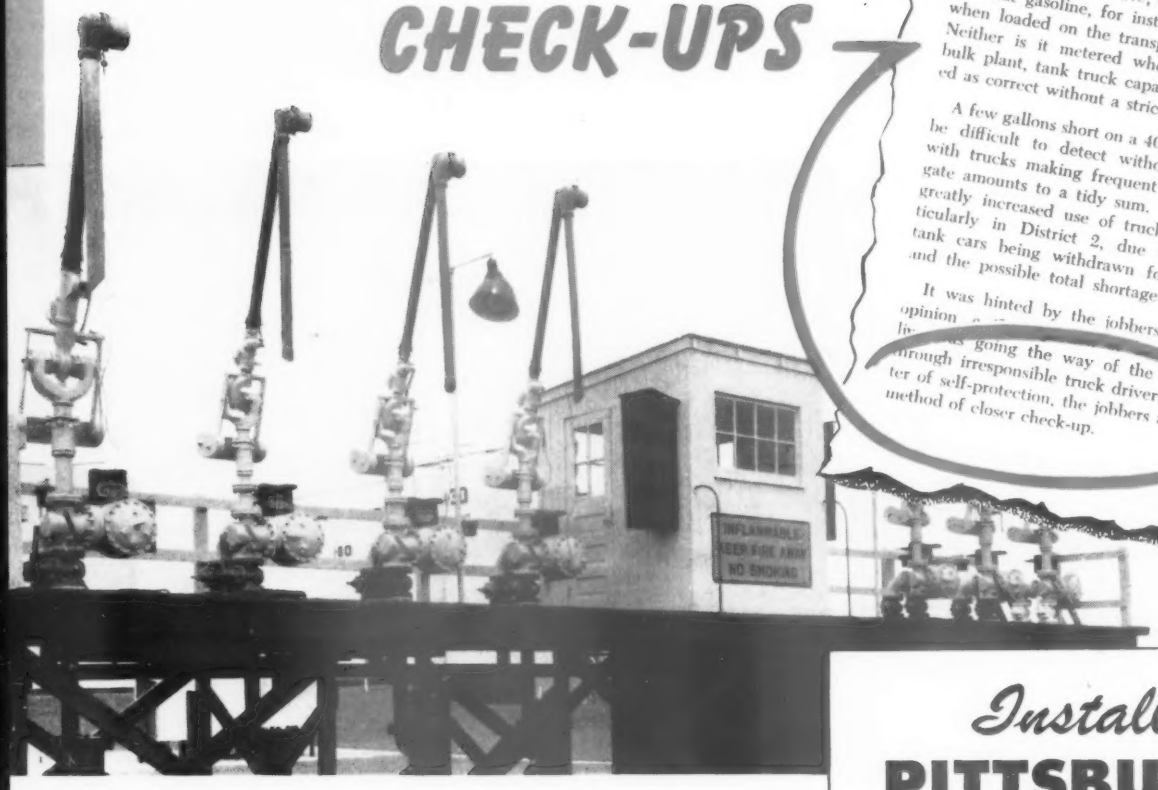
For CLOSER CHECK-UPS



CHICAGO O
:: News and Gossip in

CHICAGO—Several independent jobbers who receive their supplies from terminals by truck transports other than their own are complaining of large "shrinkage" losses which this spring have increased from a normal of about 1% to as much as 2½%, they say. They point out that gasoline, for instance, is not metered when loaded on the transport at the terminal. Neither is it metered when unloaded at the bulk plant, tank truck capacities being accepted as correct without a strict accounting.

A few gallons short on a 4000 gal. load would be difficult to detect without metering, but with trucks making frequent trips, the aggregate amounts to a tidy sum. Add to that the greatly increased use of truck transports particularly in District 2, due to all available tank cars being withdrawn for eastern runs, and the possible total shortage grows rapidly.

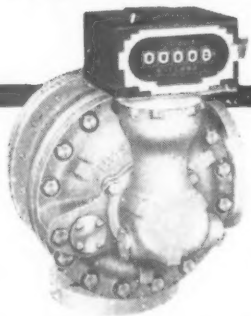
It was hinted by the jobbers that, in their opinion [illegible] going the way of the black [illegible] through irresponsible truck drivers. As a matter of self-protection, the jobbers are seeking a method of closer check-up.

ARE you, as a Petroleum Marketer, faced with steadily mounting "shrinkage losses" such as described in the inset clipping above? Then get wise to one of the first advantages of metering—that of stock control. Meters on pipeline terminals and at bulk plants, combined with metered deliveries of tank truck loads, provide exacting policing over the movement of all gallonage.

Accurate meter records, such as provided by Pittsburgh Rotocycle Meters, will reduce outages to the minimum. These meters frequently pay for themselves in savings during a period of only a few months.

Get the whole story on wartime conservation through metering. Write for details about the Rotocycle Meter and its wide application throughout the pipeline and distributing end of the Petroleum Industry.

Install PITTSBURGH ROTOCYCLE TERMINAL METERS



Pittsburgh Rotocycle Meter, Model R-5, with Straight Reading Setback Register

PITTSBURGH EQUITABLE METER COMPANY

BOSTON · BROOKLYN · BUFFALO · CHICAGO · COLUMBIA · HOUSTON · KANSAS CITY

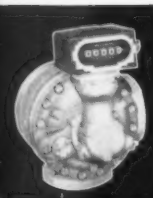
MERCO NORDSTROM VALVE COMPANY
Main Offices, Pittsburgh, Pa.

LOS ANGELES · MEMPHIS · NEW YORK · PITTSBURGH · SAN FRANCISCO · SEATTLE · TULSA

NATIONAL METER DIVISION, Brooklyn, N. Y.

Back The Attack—Buy War Bonds

There's A Pittsburgh-National Meter for Every Type of Service

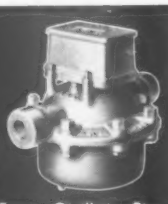


Pittsburgh Rotocycle for Bulk Plants, Tank Trucks

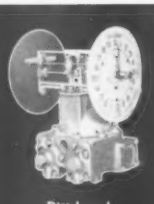
Pittsburgh Rotocycle for Pipe Line Service

Empire Streamline Oscillating Piston for Bulk Plants

Empire Thermostatic Drum Filler for Filling Containers with Petroleum Products



Empire Oscillating Piston for Refinery and Industrial Services



Pittsburgh Reciprocating Piston for Service Station Pumps

Pittsburgh Disc for General Service

MANUFACTURERS OF THE MOST COMPLETE LINE OF PETROLEUM METERS IN THE WORLD

100-OCTANE GIVES US LONGER CRUISING RANGE THAT'S WHY WE COULD GO SO FAR
THAT'S WHY WE GOT BACK
IT GIVES US FASTER CLIMB THAT'S WHY OUR FIGHTERS GOT ON TOP OF THOSE JERRIES
BACK IN HOMEVILLE
ED, YOU KNOW I WISH I COULD BUILD PLANES OR SOMETHING THAT WOULD MAKE ME FEEL AS IF I WAS MAKING WAR TOOLS
YEAH, I KNOW HOW YOU FEEL, TOM. IF EVERY-BODY COULD JUST WORK ON PLANES AND TANKS AND SHIPS AND STUFF LIKE THAT
WHY PRETTY SOON WE'D HAVE SO MANY OF THEM WE COULD BLOW THE DAY-LIGHTS OUTA HITLER AND HAVE THE WAR OVER WITH
YEAH, THAT'S WHAT I MEAN, ED...

PAW 'Comics' Stress Vital Role of Refinery Workers

WASHINGTON—Aviation gasoline plant construction workers and operating personnel of plants already producing it will start reading a new comic book this week—one, however, with a serious purpose—to stimulate the understanding that they are fully as important to the war effort as aircraft workers, shipyard workers, and tank builders.

More than 150,000 copies of this new "comic book" were being distributed this week to all plants in the U. S. now under construction, and those already producing 100-octane and in a few days will have sifted down to all the workers.

The idea was conceived, it is understood, by Bruce K. Brown, assistant deputy petroleum administrator, one Sunday morning about a month or so ago while he was working around the basement at his home. He drew up the first rough sketches—and the project was on its way.

A few days later, Mr. Brown turned to experienced artists who volunteered their services without compensation. Subsequently the "Ledger Syndicate" of Philadelphia which turns out millions of copies of popular comic books, such as "Buck Rodgers", etc., were put to work on the PAW book.

Consisting of 16 pages, the comic book is done in 4 colors, just as are those seen on most any news stand, and the "script"—or the characters' remarks, were written up by PAW men here.

One interesting feature is that all plant equipment illustrated in the book was drawn from photographs taken of actual plants, so it is technically correct in appearance.

If there is good reaction to this first book, PAW will go ahead with others, along continuity lines, and establish permanent characters, and perhaps develop a "hero". To the best of PAW's knowledge, this is the first time that the comic strip technique has been employed in industry. Officials are eagerly awaiting results.

THE ONLY CATCH IS—SUPPOSE WE DID HAVE ALL THOSE THINGS.... WHAT WOULD YOU RUN 'EM ON... TOMATO JUICE?
WELL, NO, BUT...
OF COURSE NOT. THOSE BOMBERS AND FIGHTING PLANES NEED PLENTY OF 100-OCTANE GAS! SAY, HERE COMES BILL O'NEIL OF THE TECHNICAL DEPARTMENT. OH, BILL...
MR. O'NEIL, I WANT YOU TO MEET MY FRIEND, TOM STRONG. YOU REMEMBER YOU AND I WERE TALKING THE OTHER DAY...
AND YOU WERE TELLING ME HOW MUCH AVIATION GASOLINE THE BOYS IN THE SERVICE HAVE TO HAVE
SURE THING, ED... THEY NEED PLENTY. WHY, JUST FOR COMPARISON...

AT 35 MILES AN HOUR, YOUR AUTOMOBILE BURNS ABOUT 2½ GALLONS OF ORDINARY GASOLINE PER HOUR. BUT...
ONE OF OUR FIGHTER PLANES WILL TRAVEL TEN TIMES AS FAR IN AN HOUR AND USES SIXTY GALLONS OF 100-OCTANE
PHEW! THAT'S DRINKING GAS!
SURE IS BUT THAT'S NOTHING! A BOMBER WILL USE THREE OR FOUR TIMES AS MUCH AS A FIGHTER!
EVERY AIR VICTORY WE'VE WON IN THIS WAR HAS BEEN WON WITH 100-OCTANE

E. J. Dorgan Jr. . . .

Brings 20 Years Experience to Dist. 3 Marketing Post

DIRECTING the marketing of petroleum products in PAW District 3 will be nothing new for E. J. Dorgan Jr. of New Orleans, because Mr. Dorgan has been in the petroleum marketing business for almost 21 years.

Mr. Dorgan's appointment was announced last week by Petroleum Administrator Harold Ickes. He succeeds Dudley Cornell who was named general counsel for District 3. Mr. Dorgan was drafted by PAW in January, 1943, to serve as chief of the joint use of facilities section of the marketing division under Mr. Cornell.

Mr. Dorgan's first employment after leaving St. Ambrose college was operating a service station for the Standard Oil Co. of Indiana at Davenport, Ia.

Later the Standard company sent Mr. Dorgan to Moline, Ill., as district salesman.

He left Moline in 1926 to go south with the Pan American Petroleum Corp. at Birmingham, Ala. During the period 1926-28, Mr. Dorgan was salesman, special representative, and about anything else that was needed to be done in the marketing of petroleum products.

In 1928 he became assistant district manager for the Pan American company with headquarters at New Orleans. He remained at New Orleans for three years and during 1932-33 he was office and sales manager for the company's branch at Jackson, Miss. He returned to New Orleans once more as assistant district manager in 1933 and held that position until he was drafted in January, 1943, by the Petroleum Administration for War.

Mr. Dorgan was born in Davenport, Ia., where he attended public schools.

He married Miss Marguerite Chaussier of New Orleans in 1933. The Dorgans have two children, Edmund Harry, 8, and Joanne, 5.

"The marketing of petroleum products in District 3 now is operating under a well-organized plan so far as PAW is concerned," Mr. Dorgan said, "and I see no reason for immediate changes."

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NATIONAL PETROLEUM NEWS

October 6, 1943
Volume 35, Number 40

). Promotes Foreign Oil

Ickes Reveals Magnitude of Overseas Development Program Aimed at Cutting Down Amount U. S. is Pouring into War

NPN Staff Special

WASHINGTON—Definite U.S. intentions to stimulate the increased use of foreign oil, together with some of the details as to what has been done in this direction already, were disclosed officially this week as Congress demonstrated a determined attitude that the pressure of war demands on domestic reserves should and must be lessened.

Something of the magnitude of the overseas development program on which this country already is embarked were revealed by PAW Ickes and aides, who told a meeting of western congressmen:

1—That the U.S., "where we can", is supplying materials for expansion of foreign refining capacity.

2—That all that is necessary to increase production and refining capacity in Arabia and Mesopotamia is being done.

Encourage Mexico

3—That this country is encouraging drilling in Mexico and Venezuela. Venezuelan production is now 650,000 b/d, and will be increased to 1,070,000 b/d.

4—That WPB has allotted steel to PAW for foreign use, and that as much of this "considerable" allocation as PAW is able is being supplied to Venezuela.

5—That supply deficiencies in District 5 definitely will be made up from foreign sources.

6—That although present Mexican production of about 120,000 b/d is "not much more than sufficient" to meet Mexico's requirements, "we are using some now and will use more."

7—That Persian supply "should and is being drawn upon" for oil with which to fight the war.

Disclosure Unexpected

PAW's disclosure of these facts was totally unexpected; was given to assure Congressmen that the government is making use now, and will make still further use, of foreign oil resources to ease the burden on U.S. supply.

In short, they appear to indicate that the world supply program PAW has been working on for many months is moving rapidly from the paper stage into actuality.

Evidence in support of this conclusion is to be found in the arrival here of a high diplomatic mission from Saudi Arabia, and in President Roosevelt's press conference statement on Friday that he has called for figures which will show the comparative use of petroleum products by U.S. and British forces.

That congress definitely favors easing the strain on domestic supply is amply demonstrated, meanwhile, by the outspoken comments of a group of senators, just returned from a tour of the battlefronts.

Lodge States Attitude

Attitude of the returning senators, including particularly Lodge, Mass., and Brewster, Me., is that America is being "bled white" of her oil reserves, while British oil resources are left comparatively untouched.

Reporting to the Senate on what he saw overseas, Lodge listed oil as the No. 1 item among "a number of separate items which came to my attention and which are sufficiently important to justify careful investigation and study by the Congress."

Of that No. 1 item he had this to say:

"It is a matter of common knowledge that we are exhausting our own domestic resources and that all of our people, particularly those on the eastern seaboard, are experiencing a shortage of petroleum. Yet the information was repeatedly conveyed to me that the United States with less than 25% of the oil resources of the world was furnishing over 60% of the oil being used to fight this war."

Mexico Settles Up With Sinclair, Jersey Standard

NPN News Bureau

NEW YORK—Standard Oil Co. of New Jersey announced Oct. 1 that it had made final settlement of all claims against Mexico for oil properties expropriated by the Mexican Government in a settlement totaling $22,332,484.

At the same time Sinclair Oil Corp. disclosed it had received final payment of $1,500,000 on its $8,500,000 settlement with Mexico for loss of properties when Mexico took over all foreign oil interests.

Jersey Standard revealed its acceptance of the terms after receiving notice from the State Department of the agreement effected with the Mexican government. The company said:

"After we had exhausted all legal remedies in an effort to obtain a settlement, the United States government undertook negotiations with the Mexican government with the purpose of settling all claims of American oil companies affected by the expropriation."

The $22,323,484 settlement includes

Senor Don Francisco Gastillo Najera, Mexican ambassador to the U. S. (left), gives H. F. Sinclair, president of Sinclair Oil Corp., a check for $1,500,000 to complete Mexico's settlement of $8,500,000 for Sinclair oil properties expropriated by the Mexican government

$18,391,651 indemnity and $3,940,843 interest.

State department negotiations with Mexico were secret, so no details were announced of the settlement as it affects individual properties or the basis of valuations. The settlement with Standard covers claims of 13 of the company's subsidiaries. In 1938, at the time of expropriation, Jersey estimated these properties were worth $100,000,000 to $125,000,000, a figure which included, however, potential reserves in addition to installations and operating equipment. The company made no statement as to how satisfactory it considers the settlement. Since the seizure Mexican interests have operated the Jersey properties as an integrated industry, including production, refining, transportation and marketing facilities.

Sinclair Oil Corp. received a check from Dr. Don Francisco Castilla Najera, Mexican ambassador to the United States, who paid the final settlement of that company's claim direct to Harry F. Sinclair, president. The company announced: "This completes in full the payment of a total of $8,500,000 which Mexico agreed to pay in instalments for all of the corporation's wholly-owned subsidiaries in Mexico." This transaction was the outcome of direct negotiations between Sinclair and the Mexican government, without intervention of the State Department.

Sinclair Approves Terms

Mr. Sinclair in acknowledging receipt of the final payment under the settlement recalled that he had said from the beginning that the agreement was satisfactory and that he was confident it would be scrupulously carried out. He also recalled that the company had taken the position that the settlement, although privately arranged, was in strict accord with the principle that Mexico had the sovereign right of expropriation, provided that prompt and adequate compensation was paid.

"This requirement", said Mr. Sinclair, "has been fully complied with, and it is my pleasure as well as my duty, Mr. Ambassador, to acknowledge this is in thanking you, President Camacho and your government for the complete fulfilment of the obligations of our 1940 agreement."

On his visit to the Sinclair offices at 630 Fifth Ave., New York City, Ambassador Najera was accompanied by Senor Don Salvador Duhart, first secretary of the Mexican Embassy.

Acceptance by Jersey Standard of the State Department negotiated settlement is taken as indication that other American oil firms also will accept the settlement.

Appraisal Arranged

Acceptance followed State Department announcement a few days earlier that the settlement had been reached. Appraisal of the various American interests in Mexico had been made by Morris L. Cooke representing the United States, and Manuel J. Sevada, representative of the Mexican government. Their findings were disclosed in a joint report April 17, 1942, and constitute the basis for the current settlement.

The State Department announced Sept. 29 that Mexico's total liability, as agreed on in an exchange of notes between Washington and Mexico City, would be $29,137,700, of which $5,141,709 represent interest at 3% a year on unpaid balances from March 18, 1938, to Sept. 30, 1947, date set for final payment. Acting Secretary of State Berle received $3,796,391 as one of five annual instalments of $4,085,327.45. Mexico had made a cash deposit with the United States in 1941 of $9,000,000.

In Mexico City, National Economy Minister Francisco Javier Gaxila has asked the Mexico Supreme Court to dismiss all pending injunction suits brought by foreign oil companies.

Indiana Petroleum Independents At Indianapolis Next Week

Special to NPN

INDIANAPOLIS — Current industry problems will come up for discussion at the oil war conference to be held at the Hotel Severin here Oct. 13 and 14 by the Indiana Independent Petroleum Assn. Many of the topics to be discussed have been suggested in letters sent in by oil marketers.

Speakers will include W. W. Vandeveer, Chicago, director-in-charge, PAW District 2; Warren C. Platt, Cleveland, editor and publisher of NATIONAL PETROLEUM NEWS, who will discuss "The Independent Oil Men and Today's Situation in the Oil Industry"; Charles M. Newcomb, Delaware (O.) humorist, who will talk on the philosophy of courage; Paul Ryan, chairman of the subcommittee on postwar readjustment of the Petroleum Industry War Council; Harry B. Hilts, New York, N. Y., secretary of the Empire State Petroleum Assn., Inc. whose subject will be "The Effect of Directive 59 on the Independent Petroleum Marketer in District 1"; and Capt. A. A. Nichoson, New York, N. Y., assistant to the vice-president, the Texas Co. who is scheduled to discuss "Marketing in the Petroleum Industry."

Nominations will be made to replace 3 directors whose terms of office expire this fall. A nominating committee of J. E. Fehsenfeld of Indianapolis, Beard Shirley of Pendleton and Lewis Bell of Connersville has been appointed by President Phil T. Williams.

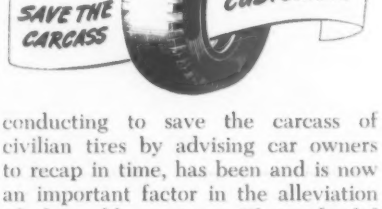
Col. Dewey Lauds "Save-Carcass" Campaign

NPN News Bureau

NEW YORK — Rubber Director Bradley Dewey has endorsed the "Save the Carcass" campaign now being conducted by the products conservation subcommittee of the Petroleum Industry War Council to acquaint the nation's drivers with the need to recap their tires to keep their cars rolling. Col. Dewey sent one letter commending the campaign to William R. Boyd, Jr., PIWC chairman, and signed another open letter "To All Gasoline and Tire Dealers."

Director Dewey in his letter to Mr. Boyd said:

"In my opinion the campaign the Petroleum Industry War Council is



conducting to save the carcass of civilian tires by advising car owners to recap in time, has been and is now an important factor in the alleviation of the rubber crisis. This splendid effort is certainly entitled to commendation.

"Unless present conservation measures are carried through, we will face a critical tire shortage. Your campaign on the recapping of civilian tires before the carcass is ruined, is one of the most important of these conservation measures because the nation's greatest stock pile of rubber is still on civilian automobiles. There will be no new tires for any but the most essential drivers at least until the middle of 1944. America's civilian transportation will be seriously crippled unless the tires on cars right now are properly cared for."

In his message to gasoline and tire dealers Mr. Dewey said:

"Paced by the nation-wide campaign sponsored by the Petroleum Industry War Council, you have rallied to the emergency and are doing a fine job. But don't let us down! For although fortunately we are now assured of an adequate supply of synthetic rubber, the job of supplying tires is still far from complete.

"None but the most essential drivers can expect new tires at least until the middle of next year. This means that it is now more important than ever that you participate 100% in America's tire conservation program by seeing to it that your customers' tires get the best of care and are recapped when necessary. For once a motorist's tires become worn beyond the recapping point, in most cases, they can't be replaced, and you've lost a customer.

"Tire conservation is a matter of good sound business as far as you are concerned, as well as your patriotic duty. Again we urge you and every gasoline and tire dealer to 'Save the Carcass' of America's tires."

Voids OPA Suspension Penalty

Texas Federal Judge Attacks 'Kangaroo' Methods in Opinion Halting Shutdown of Station Chain; Agency to Fight

Special to NPN

DALLAS, Tex.—Regional OPA officials are preparing an appeal to higher courts after a defeat handed them by U. S. Federal Judge W. H. Atwell, who held that the government agency's suspension of a chain of filling stations, under OPA's so-called "kangaroo court" procedure, for alleged violation of rationing rules is unconstitutional.

Judge Atwell declared that the practice of the OPA hearing commissioner in ordering a company to suspend business was "a modern instance of pure dictatorship," and granted the Good Luck Oil Co., operator of seven Dallas filling stations, a two-week injunction against the OPA order.

In a long opinion he conceded that the President had war powers to ration the sale of gasoline, but held that the OPA's powers do not include that of suspending a business for violation of rationing rules.

"The hearing administrator, unknown to and unprovided for by Congress, presumes to conduct a court. Procedure is prescribed by his superior for such conducting. He enters a judgment concerning which there is no limit fixed—no maximum, no minimum.

'Unknown to Constitution'

"He acts without fear of consequences for malfeasance or misfeasance. He can suspend for two weeks; he can suspend for two years. He not only is unknown to Congress but he is unknown to the Constitution. Such power is vested in one Supreme Court and in such inferior courts as Congress may from time to time ordain and establish.

Judge Atwell said that due to the growth of war powers invested in the president, there was conceived and born a hearing administrator who "is and was without constitutional father and mother."

"No attempt at baptism in the waters of conflict can change his parentage and make it legitimate," the ruling said.

Foy O. and Amos E. Wilemon

Judge Atwell

The case came up when the plaintiffs, Foy O. Wilemon and Amos E. Wilemon, operators of the oil company, sought an injunction against the closing order, which they asserted would cost them $10,000.

The suspension of the seven stations was ordered by Israel Treiman, OPA hearing commissioner, following a hearing last May in which Treiman found the oil company guilty of accepting 1,063 basic A-6 gasoline rationing coupons before their effective date. Treiman admitted that he did not think the violations wilful, but ruled it gross negligence.

Says OPA Gave Authority

Howard Dailey, attorney for the Wilemons, asserted that an employe of his clients, in a telephone conversation with the rationing board, was told that they might accept and hold coupons until after their effective date.

Judge Atwell, in a statement before handing down his decision, pointed out that the practice of accepting post-dated coupons, either through ignorance or other reasons, was fairly general at the beginning of the rationing period, and during the formation of the long and complicated provisions of the ration order.

The decision stated that the act under which rationing was legalized provided only for criminal proceedings for violations, or use of the injunction order. Judge Atwell emphasized that his ruling should not be construed as going further than specifically indicated; to wit, an order fixing a penalty under this act such as was entered is invalid. There is no doubt, he said, that Congress validly gave the President the authority to allocate any material or facilities to promote the national defense.

"We therefore have a situation which indicates validity in the entire procedure with the exception of the right of the hearing administrator to fix a penalty such as was here imposed," the judge said.

'No Fault in Statute'

"No fault can be found with this statute so far as Congress is concerned. The fault is with the board or persons who seek to act under the statute."

OPA officials here said they would continue with their hearings as they had before, and expressed the belief their procedure was legal.

Walter B. Brannon, OPA attorney in charge of preparing suspension cases, said the Oct. 13 hearing had about 20 cases already listed. He said that probably a like number of suspension or shutdown orders had been issued, forbidding firms to do business in specified commodities, since the last hearing Sept. 15.

C. B. Braun, deputy regional OPA administrator, said the adverse ruling would be promptly appealed. This appeal would normally be through the U. S. Circuit Court of Appeals at New Orleans and thence to the Supreme Court.

Significant Silence

NPN News Bureau

WASHINGTON—Treasury Secretary Morgenthau significantly made no mention of depletion allowances when he presented the administration's new program for raising additional taxes to help pay for the war to the House Ways and Means Committee on Oct. 4.

Perhaps word had gotten around to "Mr. Moneybags" that the committee had voted in executive session several days previously not to accept any testimony on this subject; that it was a "closed issue" and Mr. Morgenthau had better not fiddle with it. Authoritative word is that depletion allowances for intangible drilling costs will remain just as they are.

Cleveland to Hear Hochuli

NPN News Bureau

CLEVELAND—Walter Hocnuli, PAW marketing director, will address the Oct. 11 meeting of the Petroleum Club of the Cleveland Chamber of Commerce. Mr. Hochuli, the club's announcement states, is an authority on problems relating to the petroleum industry and on what part marketers are likely to play in the petroleum picture after the war.

Correction

American Petroleum Institute meeting, incorrectly listed in last week's NPN as coming on Oct. 8-11, will be held Nov. 8-11 in the Palmer House, Chicago.

PIPELINES—*Views of the Industry's Problems a Ref*

Washington—

Tighter Gasoline Controls Inevitable —By Herbert Yocom

WASHINGTON—It is mistaken thinking to look for any easing of gasoline rationing within the foreseeable future; mistaken because it just isn't in the cards.

Every sign points, instead, to a progressive tightening of controls on civilian consumption.

These words are backed by intimate acquaintance with the facts of supply and a pretty good idea as to the magnitude of future military requirements.

Mr. Yocom

The picture may be sketched briefly—in a half-dozen or so sentences, it is that simple:

Current total gasoline supply is approximately 1,800,000 b/d, or just about tops; production cannot and won't be stepped up beyond that figure to any appreciable extent. Out of this supply, the military is now taking 600,000 b/d as PAW Ickes has announced, leaving only 1,200,000 for civilians, or an amount roughly equivalent to what has been determined necessary to maintain essential motor transportation at home and meet other essential requirements.

Only the complete, total and unexpected early collapse of Germany, bringing an abrupt end to military activity in the European theater, can prevent the needs of the armed forces from rising still higher in 1944. The Army has told PAW what it thinks it will need next year, and what it thinks it will need is enough to stagger the imagination.

When that demand is placed atop the current daily requirement of 600,000 bbls., only one conclusion can be reached: civilian use will have to be pared still further.

How to do it, and still keep America's wheeled economy functioning, is bringing new and deeper wrinkles to the brows of official Washington; is compelling OPA, under the lash of Justice Byrnes—spurred into action by the nagging criticism of PAW Ickes—to attempt to devise some really workable ration controls.

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Lower-Quality 'Gas' Ahead

Not only will increasing military requirements mean tighter rationing, but they foretell progressive debasement of the quality of civilian automotive gasoline.

Tip-off on this is PAW Refining Director Cumming's wire to the District 5 director-in-charge, Herbert R. Gallagher, authorizing the issuance of directives to refiners controlling distillation range and limiting the output of premium grade above 74 octane to not more than 10% by volume of their total civilian automotive output (*See p.* 20). In effect, according to industry sources, this latter means a cut of two-thirds in West Coast yields above 74 octane.

Reason for the action, as stated by PAW, is the rising demand for military aviation and 80 octane number all purpose gasolines, compelling utilization of all fractions capable of use in manufacturing these fuels or base stocks, and a probable upward adjustment in the permissible ceilings on tetraethyl lead.

Although confined initially to the West Coast, the conclusion seems inescapable that roughly similar controls will have to be applied nationwide by PAW within the reasonably near future. The land invasion of Europe will require perfectly enormous amounts of all types of gasoline, but particularly 80 octane, which is the basic Army fuel.

PAW realizes that the public will complain when motorists begin having difficulty in starting their cars on cold mornings, due to lower volatility, and will explain the reasons fully in the hope of obtaining proper understanding and acceptance.

The belief here is that marketers can and probably will want to help out, through advertising the fact that their gasoline has gone to war, and by telling the public, through station attendants, what it can do on its own to get maximum performance from a poorer quality fuel.

From the industry standpoint, as well as that of the government, this seems only to add up to good public relations. What is more, it will give the industry another good chance at telling its customers what a bang-up job it is doing in meeting military requirements.

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Want to Keep Key PAW Men

PAW Ickes and Deputy Davies are becoming extremely agitated at a growing industry demand for return of oil company employes now in key PAW positions.

With departures from PAW operating divisions—Transportation, Production, et al—taking place with increasing regularity in recent weeks, both are said to entertain serious doubts as to their ability to keep PAW functioning as a smoothly-knit organization unless the trend is halted.

Mr. Davies always has held to the viewpoint that the staffing of PAW with high calibre executives, on leave from their companies, was the best means of assuring PAW's rapid liquidation at the end of the war. He manned PAW in that manner deliberately, knowing that, come peace, his staff would move back to higher paid jobs in industry almost automatically.

This seems like pretty solid reasoning, and something that the industry might well think about now. Industry wants government out of the oil business as soon after the war as possible, but if it compels PAW to replace top-flight executives with low-bracket employes and perhaps—Heaven forbid—even college professors, then PAW easily could become just another federal agency.

Atlantic Coast—

OPA Guns for TT Black Market —By Henry Ozanne

NEW YORK—In the last 60 days 102 gasoline stations in the New York metropolitan area have been suspended from doing business for periods of one week to 6 months, it was announced here over the week-end by Edward L. Coffey, chief district OPA attorney. The information was disclosed after an intensive 2-months anti-black market campaign by OPA and Treasury Department Secret Service agents.

Mr. Ozanne

The enforcement drive was directed mainly against dealers who were buying "B" and "C" ration coupons, and so successful was the campaign against that practice that Mr. Coffey announced that such type of racketeering has been virtually wiped out locally, "although other leaks still exist."

The sentences were imposed in most cases on dealers who had been buying up "B" and "C" coupons for replenishing their stocks which they had depleted through above-ceiling sales without exchange of coupons.

Counterfeit as well as stolen coupons were found to be widespread, and the convictions prove, said Mr. Coffey, the danger in attempting black market operations. "If the dealer purchases coupons, itself an illegal act, he may not know that they are counterfeit, but if so our investigation will reveal that fact quickly. So a dealer whose gasoline return sheets show a substantial number of counterfeit coupons when checked at the ration bank stands accused by that fact of purchasing coupons or otherwise illegally acquiring them."

OPA also declared it was now turning its attention to ending the black market in "TT" coupons. These have been affording a lucrative racket to certain truck operators because of the difficulty of

...Reflected by NPN Writers at Three Vital Points

checking on the issuance, Mr. Coffey explained. Most large truck-fleet operators customarily have a part of their trucks idle for repairs or other reasons, and hence there is an "overplus" of the 5-gal. coupons. Many of these have been sold on the black market.

These "TT" coupons for the most part are genuine, OPA reports, and hence this type of racket is easier to combat. However, last week 15 station operators were convicted of accepting counterfeit "T" coupons in Rhode Island. In addition the coupons bore improper endorsements and lacked car registration numbers. Penalties were imposed by Chief OPA Hearing Commissioner Arthur L. Brown at Boston who has jurisdiction over the Providence, R. I., region where most of the violations occurred. In these cases OPA did not charge that the dealers knew the coupons were bogus, but contended that they had aided and abetted the black market by taking improperly marked coupons.

One of the first dealers convicted in New York, Solomon Hanft, of Elmhurst, Queens, said in admitting his guilt:

"I just couldn't make a living. I knew the rest of the dealers were doing it, and although I knew it was wrong, I did it to have something to eat."

Another convicted dealer in the Bronx said: "Ninety-eight per cent of all gasoline customers will not put their license numbers on the backs of coupons. You shouldn't blame the dealers; you should blame the motoring public."

One of the biggest coupon counterfeiting plants in the East was raided in Philadelphia last Sunday and bogus ration stamps for 10 million gals. were seized. A complete printing press and stocks of special paper were confiscated. So cleverly faked were the stamps that ultra-ray tests were needed to establish the fact that they were spurious.

Anti-black market drives continued in New England. Three men were arrested in Delaware with 1200 counterfeit "A" coupons in their possession. In Rhode Island further round-up of racketeers trapped 3 shipyard workers. Also in Rhode Island, the Scituate ration board was robbed of gasoline books representing 590,000 gals. of fuel oil.

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Taxable gasoline sales in New York State for July continued to run 30% below those of July, 1942, although indicating a somewhat heavier motor traffic than during June this year. Taxable July motor fuel sales totalled 97,105,980 gals., announces Rollin Browne, president of the State Tax Commission. This compares with 91,573,607 gals. sold in June, 1943, and 140,175,495 for June, 1942. Including non-taxable sales, total consumption of motor fuel in the state in July was 110,501,148 gals., as against 132,410,845 gals. in July last year. Motor fuel tax receipts, in the August collection period corresponding to July sales, amounted to $3,846,014 as against $5,559,811 a year ago.

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'B', 'C' Books Squeezed

Rationing boards of New York, New Jersey, Pennsylvania, Maryland, Delaware and the District of Columbia are reviewing all gasoline books except those in the "A" and commercial categories in an attempt to squeeze 24,000,000 gals. a month out of the region's consumption. Sylvan L. Joseph, OPA administrator for the 5-state area, said all coupons not needed for essential use will be recalled after a review of recent issuance of all "B" and "C" books and books for non-highway users, including farmers.

Mid-West

Encourage Group Riding by War Workers —By Earl Lamm

CHICAGO—The Mid-West is looking to its Washington congressmen to straighten out the gasoline rationing snarl caused by the reduction of available civilian supplies in the effort of PAW and OPA to "squeeze the water" out of B and C coupons already issued, by reducing their value from 3 gal. to 2 gal.

Mr. Lamm

More people here are angry at the manner in which the cut was made than at the reduction itself. OPA did take advantage of the wide-spread oil industry advertisement in leading District 2 newspapers Sept. 26, it has been asserted. Industry men assert the advertisements were intended for a softening up process for the deeper cut.

An information leak concerning the reduction brought banner headlines in many newspapers over the Mid-West and caused a flurry of excitement. Many motorists rushed out and filled their gasoline tanks ahead of time at 3 gal. per "A" coupon, only to find later that "A" coupons were the only ones not cut.

Regional OPA gasoline rationing representatives, who started a special drive a week ago, putting the pressure on reduction of consumption, are still at it. They are visiting all local boards, according to OPA regional office here, and are going over applications that do not appear right at first glance, "to establish uniformity." Gasoline allotments to farmers are going to be looked into also, whether they are for highway or non-highway use.

Instructions to put motorists through the gasoline wringer were sent to all OPA district offices on Oct. 2, with new follow-up letters from Raymond S. McKeough, regional administrator, and his rationing executive, Edward F. Stegan, three days later.

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Cancels Supplemental Directive

District 2 PAW Director Vandeveer has cancelled his directive of Aug. 23 for the supplemental shipment of 50,000 b/d of motor gasoline to District 1. Supplies were very short and the order threw some refiners into a tail spin from which many of them are just now recovering. It is doubtful if all refiners were able to comply fully due to the shortage of crude oil, and the cancellation of the order provides that any refiner unable to comply in September is to complete the shipments in October.

Cancellation of the directive was made on the basis of assurances given by the supply and distribution committee at a meeting in Chicago, Sept. 29, that a total of 129,000 b/d of motor fuel would be shipped to Districts 1 by all refiners in October. This amount is 22,000 b/d less than the total of 151,000 b/d scheduled for shipment during September, and the S. & D. committee believed it could be handled without a PAW directive.

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Seek Freight Compensation

At the Sept. 29 meeting the committee is also said to have passed a resolution calling upon PAW to get Defense Supplies Corp. to compensate mid-western refiners for extra transportation cost on shipments of West Texas sour crude, provided they will agree to use it.

Various cost figures have been discussed from time to time, but the "measure of reimbursement" asked for by the S. & D. committee is said to be 12c per bbl. over the pipeline tariff. This 12c is supposed to be the through rate from West Texas to Cushing, Okla. One example cited by a refiner was the pipeline tariff from Cushing to Chicago, which is 37c. Add 12c and the total is 49c. Tank car rate is $1.12, West Texas to Chicago, or a differential of 63c for DSC reimbursement.

However, Mr. Jones is reported to have a plan of his own, which is to purchase the West Texas crude outright, transport it to the refineries by tank car, and sell it at a loss. This would be similar to operation of the Big Inch pipeline.

Something definite on the compensatory plan is hoped for shortly, as C. H. Alberding, PAW director of refining, District 2, sent out a letter on Sept. 28 asking for a definite schedule of the amounts of West Texas crude each refiner can use (See p. 22).

Michigan Jobbers Demand Manpower Relief

Warn of Cold Homes Unless U. S. Marketers Are Ruled Essential; Weigh Problems With Vandeveer; Slam OPA on Coupon Change

TRAVERSE CITY, Mich.—Independent jobbers of Michigan, as the Michigan Petroleum Assn., met here Sept. 29 and 30, discussed their marketing troubles, heard and questioned District 2 PAW Director Vandeveer and 3 of his associates in one of his "grass roots" visits to the oil industry, and then adopted resolutions asking:

Increase in price of crude oil; greater imports or other increase in crude supply; increased costs be passed to the consumer; WMC to declare all marketing essential.

The jobbers went on record as favoring the present coupon banking system rather than the proposed roll-back.

Royal E. Decker, director of the association, retiring jobbers' representative on the PIWC, and president of the National Oil Marketers Assn., assured the jobbers that there is a real and serious crude oil shortage. Despite the drilling of as many wildcats as in recent years we are still not finding the oil. A higher price for crude, sufficient to bring in more oil, is his recommendation. Idle refining capacity of more than 200,000 b/d in District 2, he said, is affecting jobber and major alike.

Jobbers are being stripped of their manpower to such an extent that their service to the public, particularly on fuel oil this winter, is being greatly restricted because WMC will not declare marketing an essential business. When homes are cold this winter, he said, WMC Chief McNutt may learn that it is highly essential.

Deputy PAW Davies sees essentiality of marketing and particularly of the jobber, why cannot McNutt? He quoted A. Clark Bedford, of the Standard of New Jersey as revealing recently that 90% of the gasoline distribution on the East Coast is through Independent jobbers and dealers.

Claims West Needs More 'Gas'

Mr. Decker said the present rationing system does not work, nor is it fair to the West. The East, because of its congestion and vast suburban and urban transport systems does not need the "gas" like the West. Detroit was built by and for the automobile and nothing else, for illustration.

In the discussion on this subject, Leigh Morden of Lansing said the story of the crude shortage should be taken to the people; that they do not understand it and one advertisement will not do it. Dan Halev, Quality Seal Oil Co., Saginaw, asked that resolutions committee report a resolution that Congress see to it that the Allies produce and use more of their own oil in the war.

"Manpower Shortage" was discussed by Paul R. Kempf, of the Staebler-Kempf Oil Co., Ann Arbor, chairman of the association's War Emergency Committee. He said this committee, consisting of chairmen of other committees, meets once a month. Unless oil marketing is allowed not only to keep its truck and other plant men but is given more, he predicted many Michigan homes will suffer this winter if for no other reason than inability of the oil marketers to move fuel oil, even if there should be enough fuel oil which is doubtful.

Can't Meet War Plant Pay

According to estimates, the oil industry will lose 24% of its employes in the October draft unless something is done. In addition to the draft, Mr. Kempf said, marketers are losing men to war plants. A bomber plant, 13 miles from Ann Arbor pays $10 a week above his top price for bookkeepers while truck drivers leave oil companies for the $75 to $85 a week war wages. Marketing, at present prices cannot afford to meet these wages nor is it allowed to by local manpower and war labor representatives.

"Our responsibility is to the public and to keep their homes warm so we should oppose all drafting of our necessary men from now on," he said.

WMC, Mr. Kempf said, declares that it receives no complaints from oil marketers against the drafting of its essential men. He called on all to send protests against drafting truck men and supervisors to ODT, both locally and nationally, with carbons to him as chairman of the War Emergency Committee of the association.

Michigan has 22 zones for ODT and WMC and Mr. Kempf insisted that oil jobbers should have a representative on each of the committees for these zones.

Wants Estimate of Cold Homes

"To drive the importance of declaring oil marketing essential and saving its manpower from the draft," Mr. Kempf urged, "make as good an estimate as you can today as to how much under your customers actual needs for fuel oil you will probably fall with your present and prospective losses of men. In short get a picture of your manpower troubles in terms of the number of cold homes among your customers this winter and give that picture to your zone committee and to your state War Emergency Committee. These draft and War manpower boards just do not think this oil and transportation shortage is real yet."

I. B. Dworman of Detroit urged the association to concentrate on getting occupational deferment for Michigan oil marketers who are serving a particularly cold country and let the rest of the country look after its own story.

Executive Secretary Joseph D. Hadley reported that Michigan had 41 jobbers' costs questionnaires returned to date but it needed 6 more to meet its quota of 47 and the deadline expired the next day. He said that when plans were first made for the questionnaire in order to see if the jobbers need more margin, nothing was said about a quota until after the members of the planning committee had returned home. He questioned the need and fairness of a quota, especially of this size. Various members agreed to phone the jobbers selected by Washington to fill the quota.

Elmer Ledbetter, Wayne Oil Co., Detroit, and John Jankowiak of Pinnconning and president of the association, debated the 72-hour limitation on station operations.

Mr. Ledbetter, in taking the affirmative on the present limitation on station hours said: "With the protection of this rule an independent jobber only needs 3 to 5 service stations in an average town to meet the staggered hours of majors."

The need for the greatest conservation of manpower is illustrated, he said, by the fact that in the first 8 months of this year his business is off 56% for regular gasoline but that his Ethyl gasoline sales are up 30% because, he believes, the public is buying the best and high-priced articles. He has no evidence of dissatisfaction with present regulations and believes 90% of the people are for it.

Ag'in Gov't. Rules

President Jankowiak said he was constitutionally against government rules because they didn't work or work fairly. He denied that the 72-hour rule conserved manpower against the pull of the draft and the war plants. He argued that a man should keep open as long as he could and get reasonable volume of business—whether it was 72 hours a week or more or less. The industry's job is to maintain the public's automotive equipment.

Pledges Probe of Violations

Mr. Fehsenfeld of the Crystal Oil Co., Grand Rapids, supported the opposition to the present regulation. From his own knowledge he said stations increased their gallonage from 50 to even 100% when they stayed open past the 72 hours. In the small towns he said station owners were ignoring the rules completely.

Chairman Kempf said the War Emergency Committee would take up violations if the members would report them.

Galen Wilson of the Frank'in Oil Co., Saginaw, in discussing jobbers' transportation problems said this winter would be the most serious of the industry's problems.

Trucks should be loaded for the absolute maximum regardless of road and

(*Continued on p.* 36)

Wisconsin Jobbers Roast OPA at Spirited Session

Special to NPN

MADISON, Wis. — Opposition to OPA rationing methods and "discriminatory and unfair" enforcement procedure cropped out at the PAW and OPA "grass roots" conference with the marketing branch of the oil industry held here Sept. 28.

The meeting was sponsored by Wisconsin Petroleum Assn. and was attended by about 100 oil men. Ernest L. Hughes, director of marketing, and H. W. Nankervis, chief, facilities section, represented PAW District 2. OPA representatives were Lawrence Vass, fuel oil ration chief from Washington, and Leonard Campbell, E. L. McElroy and J. A. Miller from the Wisconsin state office.

Roy L. Brecke, association secretary, as chairman of the meeting, declared: "OPA—this has been our pet peeve, as most of you know. Up to date, in nearly every instance where OPA has seen fit to make a horrible example of some one not living up to regulations, they have picked on some small independent."

"OPA regulations," he asserted, "are discriminatory and unfair."

To illustrate, he said that when a major company leased a station and the lessee violated the OPA regulation, OPA did not close down the station, but the major company simply replaced the lessee, with the OPA allowing the company a complete stock to start over again.

'Different for Independent'

"If it is an independent on a salary basis," he continued, "then it is different. They close the station for 10, 30 or 60 days, or even for the duration."

He also charged OPA with closing down an independent jobber in Milwaukee for a year for selling naphtha without ration stamps, whereas, he said, nearly every major company has been selling naphtha ever since rationing started. "Why put independents out of business and let some majors continue?" he asked. "Why not ration naphtha?

"We do not believe it is fair and equitable for the OPA to act as jury, judge and entire court. We believe all decisions should be made subject to court appeal."

In announcing that he himself had been cited by OPA for gasoline rationing violations, he charged it was done for political reasons, because he is secretary to Gov. Walter S. Goodland, who two months ago opposed OPA's enforcement activities in stopping private cars to question drivers about possible violations. This occurred during the summer vacation season, about July 4.

Dealers Cite Problems

In open forum discussion of fuel oil rationing and trade conditions, the jobbers told of difficult problems.

Tony Fiore of the Fiore Coal and Oil Co. in Madison asserted there was too much restricting from Washington and said fuel oil rationing should be put on the jobber level, with the different state legislatures exercising state rights.

Harry McGaughey, Racine jobber, held local boards should be given some latitude in handling exceptional cases. Charles Lockwood, Kenosha, said that as long as OPA continued to give supplemental rations and would not let any family freeze, he felt they should do away with the ration periods and deliver the whole year's supply at one time. There seemed to be considerable agitation for elimination of periods.

The PAW men, who came on the program last, talked of further decentralization of PAW to localize governmental authority and get closer to the industry.

Plan Crude Supply For New Pipelines

Special to NPN

HOUSTON—The crude oil supply subcommittee of the District 3 general committee met in Houston during the week to formulate plans dealing with physical problems related to supplying crude oil for the 42,000-bbl. pipeline to be built by Magnolia Pipe Line Co. from Midland to Corsicana, scheduled for completion about March 1, 1944, and the Stanolind Pipe Line Co.'s 65,000-bbl. line from the Slaughter pool, Hockley county, Tex., to Drumright, Okla., scheduled for completion about April 1, 1944.

If Magnolia and Stanolind were required to install facilities extended throughout West Texas to gather oil large expenditures of critical materials would be necessary and duplication of gathering facilities would occur in many fields. To avoid such improvident use of materials, representatives of crude oil purchasers in the area were invited to the meeting to discuss with the subcommittee each company's ability to contribute to a plan calling for minimum expenditure of material and manpower, and no duplication of gathering facilities.

Push for Products Rise

Because of the serious threat of reported plans to increase crude oil price ceilings without improvement in products ceilings, Frank E. Holsten, president of the Gulf Coast Refiners Assn., and on behalf of the membership, recently filed the following telegram with Economic Stabilizer Vinson and other authorities in Washington:

"We believe an increase in the price of crude oil should be very essential in order to increase activity in the various departments of production and to supply the much needed crude oil for manufacture of war essential products and essential domestic products; however, the increase in the price of crude oil without a corresponding increase in the price of refined products would be very detrimental especially to the numerous non-integrated refiners throughout the country. Manufacturing costs have been increased tremendously and it would be impossible for refiners to absorb a crude increase without compensatory increase in the price of their products. Without a products increase production of needed materials would be very seriously hampered."

George Reid, executive secretary of the Gulf Coast Refiners Assn., said recent published statements to the effect that the petroleum refining industry can absorb the admittedly needed proposed increase in crude oil price ceilings because of present profits in refining operations, are too loose in application to be accepted as fact.

Not a Broker, Court Rules; Throop Faces Injunction

Special to NPN

DETROIT—Federal District Judge Ernest A. O'Brien on Sept. 29 found that an injunction should be issued against J. V. Throop, operator of the J. V. Throop Petroleum Co., Ypsilanti, Mich., enjoining him from further violations of OPA price ceiling regulations.

Mr. Throop is charged with buying oil at ceiling prices and selling it for .125c above ceiling prices—the .125c a gal. charge being for his services.

Judge O'Brien decided that Mr. Throop is not a broker and cannot operate as he has, under OPA Regional Price Interpretation 25, which states that, if a buyer needs assistance in finding available oil, he may employ a broker or anyone else to render such service and to pay the party so employed. Because Mr. Throop did not inform purchasers of where oil came from, he was ruled not a broker.

Issuance of the injunction was withheld for 2 weeks to enable Mr. Throop and OPA to work out some kind of deal to keep him from going out of business. The decision came on his 43rd anniversary in the oil business. No decision on OPA's treble damage suit for $106,000 against Mr. Throop was reached.

Report Cooperatives Seeking National's Refineries

NPN News Bureau

CLEVELAND—Sale of National Refining Co., Cleveland, is under way, with a satisfactory turnover of shareholders' stock reported by Otis & Co., local investment house, which is reported acting for a syndicate promoting the transaction.

The syndicate is said to be made up of Cyrus S. Eaton, Otis & Co.; Chester Canning, Providence, R. I., Pacific Gas Corp.; Albert List, Fall River, Mass., buyer of properties for liquidation; and I. A. O'Shaughnessy, president of Globe Oil & Refining Co.

Reports are again current that National's 2 refineries, at Findlay, O., and Coffeyville, Kans., are to be purchased by cooperatives. Ohio Farm Bureau Cooperative Assn., Columbus, O., is reported dickering for the Findlay plant, while Consumers' Cooperative Assn., Kansas City, Mo., is said to be interested in acquiring the Coffeyville refinery.

Crude Price Showdown Ready

40 Independent Producers Jam Capital as Aroused Congressmen Hold Caucus; Legislation Forcing Rise is Possibility

NPN Staff Special

WASHINGTON — The long-awaited showdown on the question of a crude oil price increase is in the offing at last.

Backed by an aroused delegation of independent producers—who are in town to stay until they get what they want—Congressmen from the oil producing states intend seeing to it that the issue is settled quickly and favorably by the New Deal administration or go ahead with legislation providing for the increase, the certainty of a Presidential veto notwithstanding.

As yet, there is no word from the White House to indicate that the administration will reverse its two previous denials of the price boost recommended by PAW Ickes.

Hold Oil-State Caucus

This explains the caucus of oil-state congressmen and senators which convened in Washington Oct. 6 for a "full, free discussion of the whole question of petroleum, including the question of price and the desirability of legislation" on the price issue.

It explains, also, Monday's attempt by Sen. O'Mahoneey, Wyo., to ascertain from Ickes whether PAW would consider recommending enactment of legislation providing for such an increase in the event that Stabilization Director Vinson turns down Ickes' appeal from the two OPA denials.

Ickes, of course, could not answer as to that. As a member of the President's cabinet, he could not very well commit himself to fly in the face of a White House dictum against an increase. What is important, however, is that the O'Mahoney question shows the way Congress is thinking; that it intends taking the bit in its teeth and would welcome PAW's continued support—feels that it needs it, in fact.

'Evidence' is All In

So far as the "evidence" required by Judge Vinson to pass on the merits of the proposed increase, that apparently is pretty much all in. OPA has submitted its arguments in support of a turn-down. PAW has informed the stabilization chieftain how it believes the increase should be applied to present price schedules, including those for refined products, and, outside of possibly a few odds and ends of information that may be called for, doesn't have anything additional to offer.

Summed up, this means that to all intents and purposes the matter is definitely and finally in the hands of Judge Vinson. If there is any delay in coming to a decision, Congress needs look no further than the White House for an explanation.

In the meantime, the independent producers leave no doubt as to their intentions.

On Oct. 2, Frank Buttram, president of the Independent Petroleum Assn. of America, said some 40 independent producers were meeting in Washington to provide added impetus to the fight now more than 2 years old "to obtain official recognition of the critical condition of the nation's supply of petroleum and remedial action on that situation at the hands of those who have not only 'frozen' prices, but productive energy as well in this industry."

Cost of finding, developing and producing a barrel of oil, Mr. Buttram said, has gone up 48c since late 1941; that there has been no increase in crude prices except for small, local "adjustments"; and that new oil is being found at a rate no greater than one-fourth the amount being consumed.

"The oil producers," he summed up, "know how to get the oil. They have been asking for conditions that would let them do their best. They look upon it as their patriotic responsibility to stay in Washington until this situation is corrected."

House Group Hears Jester

On Oct. 4, the House Naval Affairs oil subcommittee, headed by Rep. Rivers, S. C., heard further appeals for a crude price hike from independent producers and Beauford Jester, Texas Railroad Commission chairman.

Vinson Glad to Have Views On Need for Crude Hike

NPN News Bureau

NASHVILLE, Tenn.—Gov. Prentiss Cooper of Tennessee has received acknowledgment of resolutions urging higher crude prices which the governors' conference at Denver recently sent to President Roosevelt (*see NPN Sept. 22, p. 3*).

Acknowledgment came from Economic Stabilizer Vinson and is quite similar to acknowledgments sent by Mr. Vinson to others who have called his attention to the need for higher crude prices.

Mr. Vinson's letter to Gov. Cooper follows:

"The President has referred to me for reply copy of the telegram of Sept. 19, 1943, in which you joined with other governors expressing your views concerning the question of the necessity for increasing the ceiling price for crude oil and crude oil products.

"I am pleased to be informed of your interest.

"Very truly yours,

"(s) Fred M. Vinson"

WAR OIL NEWS *from* WASHINGTON

HERBERT YOCOM *Bureau Chief*

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Mr. Jester said the demand outlook for petroleum products, particularly from our armed forces, must have immediate serious consideration to determine ways and means of promoting more intensive search for new sources of oil.

He said that a statement by Sumner Pike, OPA oil price chief, that profits are being made by oil companies is evidence that there is no need for a price increase, is incomplete and incorrect.

"It is my information," he told the committee, "that he used the reports of some 30 major oil companies having production, pipelines, and refineries. These companies *are* making money out of the refined products. They buy all the oil they can get. Price is no object when they have war contracts for war products for oil. These companies buy the wells of independent producers at high prices to obtain needed oil.

"But the thousands of independent oil producers are not making profit if they are in debt for their drilling and operating costs. The stripper-well operators are actually losing money in producing oil at present prices. Many stripper wells have been shut in for that reason, and this is lost production."

He said that if Mr. Pike's theory is followed, the independent operators will be squeezed out and absorbed by the major companies which he termed "un-American and ruinous to the independent operators . . . in the independent operators lies the hope of preventing an oil monopoly in the U. S."

When OPA denies a crude price increase, he said, because of its policy of "holding the line" on prices, it overlooks the fact that the price of oil has not been allowed to come up to the line of prices of food, farm products, raw materials, labor, and operating costs and oil ought to be allowed to come up to that line.

Judge J. C. Hunter, president of the Mid-Continent Oil & Gas Assn., and Texas representative of the Interstate Oil Compact Commission, followed Mr. Jester on the stand.

He told the committee that even if an increase of 35c per bbl. had been sufficient when recommended originally by PAW Ickes, it would not be adequate now because costs have risen greatly since then.

Home Front Backs Scrap Drive 100%

Every U. S. Community Enlisted, WPB Reports; Oil Industry's Share of 15,000,000-Ton Goal is Put at 180,000 Tons

WASHINGTON—Every community in the U. S. has enlisted in the War Production Board's "Victory Scrap Bank" drive, by means of which it is expected that 15,000,000 tons of iron and steel scrap will be raised by Nov. 15. Of the total tonnage, the oil industry is expected to supply 180,000 tons.

Objective of the drive is to insure against a possible shortage of iron and steel scrap needed for continuing and increasing production of necessary weapons of war. Consuming steel mills and suppliers have reported they have on hand only enough scrap for 2 months. Representatives of these companies have expressed to the government the need for such a drive. They have pointed out that in order to keep pace with requirements of the armed forces a ready supply of scrap must be assured through the winter months and thereafter. The need for more iron and steel scrap is indicated in the production comparison of 1943 against 1942.

Arms Output Doubled

Increase in the production of all munition, all Navy tonnage, and all merchant shipping is just double. The 31-day delay in opening navigation last spring, resulted in shipments of ore being off 8,000,000 tons from last year; an early closing or a late opening of the Lakes navigation would further curtail the shipment of iron ore; it is practical that, no matter what emergencies arise, the mills and suppliers have on hand sufficient inventories to meet the emergencies.

The Council of State Governments, including the governors of every state and the various state subdivisions are helping in the direction of the drive and cooperating to the fullest extent with local, state and regional salvage organizations. Steel companies have stated that they will increase their inventories, thereby making it possible for scrap dealers to move the newly-collected scrap into their yards for proper preparation.

WPB Units In Charge

Four branches of the WPB Salvage Division are involved in the all-out program. General Salvage Branch covers collection from farms, households, retail establishments, office buildings, etc. Industrial Salvage Branch has salvage programs in operation in all industrial and manufacturing plants, mines, railroads, shipyards, utilities, etc. This division is expected to supply 9,800,000 tons of the total.

There are some 600 industrial center operations' committees located in practically every industrial community in the country. Meetings of these committees currently are being held, aimed at renewing the drive to move all dormant scrap, speeding up the flow of production scrap, properly segregating and maintaining the identity of all metallic scrap and showing the proper methods of handling borings and turnings and all the alloys.

7000 Industrialists Take Part

There are some 7000 top industrialists voluntarily working on these committees who carry the programs in detail to the 74,000 plant salvage managers. Their program now is the dormant scrap drive.

Management, with the assistance of the industrial branch representative and industrial center operations' committeemen, will be asked to inspect their plants again and to make a list of all dormant scrap items contained on that list. Dormant scrap is defined as machinery, equipment, tools, dies, jigs, molds, fixtures, which are obsolete or incapable of current or future use in war production.

The scrap processors branch of the salvage division has completed plans for a cooperative operation between the scrap dealers and the local salvage committees. Details of operation of local community "Scrap banks" will be worked out jointly by dealers and local committee members.

Publications Cooperate

Local advertisers have been asked to devote as much of their local paid advertising space as possible to the Victory Scrap Bank drive. Farmers have been requested to "harvest" all of the scrap they can comb their properties for.

Low Return of Questionnaires Shuts Door On Margin Hike

WASHINGTON — Lack of sufficient returns from jobber-dealer questionnaire virtually forecloses possibility of PAW recommendation to OPA for gasoline margin increase.

Extended deadline for returning questionnaires to PAW passed Sept. 30, and latest tabulation shows PAW received far less than minimum sample required by Budget Bureau, only 22% of necessary number of dealers responding and only 39% of jobbers.

Aid Ecuador Rubber Output

WASHINGTON — Reports received by the Institute of Inter-American Affairs, say a new 30-mile trail under construction in Ecuador is aiding in the collection and export of rubber for United Nations war needs.

Endorse All Gasoline Coupons At Once and Fully, Says OPA

WASHINGTON—Graphic instructions showing motorists how to endorse their gasoline coupons were released Sept. 29 by OPA, with the following advice:

Endorse every coupon in rations books immediately; do not wait until buying gasoline before endorsing coupons. Holders of "A," "B," "C," "D" or "T" books should write license number and state of registration on face of all coupons; holders of "E" or "R" books should write their names and addresses on the face of all coupons. Holders of interchangeable book coupons for official or fleet vehicles should write official or fleet designation and city and state of main office. If the commercial vehicle does not operate under a fleet designation, the number of the certificate of war necessity is to be written on the coupons.

Endorsement of coupons, says OPA, has a twofold purpose:

"First, it protects consumers against use of their coupons by others in case of theft or loss.

"Second, it enables the Government to locate criminals who have been trafficking in illegal gasoline. By checking back the ownership of gas coupons that had been handled by suspected stations, the Government can determine whether a station is operating legally or illegally."

Fuel Oil Sellers Relieved Of Giving Free Service

WASHINGTON—Sellers of fuel oil who were giving free oil burner maintenance and repair service in connection with their sales of fuel during 1941-42 heating season may now discontinue such service without reducing their maximum prices for fuel, according to Amendment 129 to RPS 88.

Amendment, issued Oct. 2 but effective as of Sept. 23, provides that maximum prices for sales of oil burner maintenance and repair services shall henceforth be determined in accordance with Supplementary Service Regulation 19 to MPR 165 (services), also effective Sept. 23.

Fuel oil prices in areas where free burner service was formerly offered by suppliers were generally in line with comparable areas where free service was not available, OPA explains, with sales of new oil burners, which is no longer possible, helping to defray expense.

Suppliers in Baltimore and adjoining counties were permitted to discontinue this service by Amendment 34 to RPS 88 issued last October, which also set specific prices for the service if continued. Effect of Amendment 129 is 2-fold: (1) to extend this privilege to suppliers in all localities, and (2) to remove price control for the service from RPS 88 and place it, with other service prices, under MPR 165.

'Gas' Squeeze Just a Prelude

Equalization East of Rockies Brings Moderated Groans; Districts 4 and 5 to Suffer Next—and Then—

NPN Staff Special

WASHINGTON—The real squeeze on gasoline rationing appears to have just begun, with "equalization" east of the Rockies and an imminent cut in District 4 and 5 rations just a prelude to greater nation-wide curtailments.

Even before the smoke had cleared from OPA's cut in "B" and "C" coupons in Districts 1, 2 and 3, PAW Ickes on Oct. 4 told far-western congressmen that civilian gasoline consumption in Districts 4 and 5 will be cut about 15,000 b/d, or about 10%, in the near future. Significantly, he pointed out that he was unable to promise "that later on there won't be greater curtailment for all parts of the country."

Plans for the western cut in rations, which will remove rubber as a reason for rationing in the Rocky Mountain and Pacific Coast areas, were outlined by Mr. Ickes and Deputy PAW Davies at an open meeting called to educate congressmen from the 10 affected states as to the need for the action.

Davies Sums Up Situation

Mr. Davies presented the following reasons:

1—Stocks of automotive gasoline in Districts 4 and 5 are now just under 20,000,000 bbls. and dropping fast towards the 15,000-bbl. minimum safe working level. If present consumption rate continues, minimum level will be reached "in the next 2 or 3 months, then decline rapidly into an area that represents the impossible."

2—The military is now taking 43.4% of all gasoline produced in the two districts, compared to 23% in 1942 and an estimated 1944 take of 52.4%.

3—Demand for crude oil and natural gasoline is outstripping production now by 200,000 b/d—the difference between 1,200,000 and 1,000,000—and the gap will continue to widen, forcing increased use of outside supply sources, which PAW is preparing to do.

4—Unless consumption is cut and the supply deficiency made up from outside sources, crude oil and product stocks will drop below the 100,000,000-bbl. minimum safe working level by March, 1944. At the war's outset, stocks totaled 160,000,000 bbls.; are now 130,000,000 bbls.

No estimate of coupon values when cut is made was given the congressmen. However, Charles Phillips, chief of OPA's automotive rationing division—which handles gasoline rationing, assured them that every effort will be made to channelize gasoline to essential uses.

Far Ahead of Critics

Governmental agencies were thus shown to be far ahead of their critics, who will undoubtedly howl long and loud at the cuts already made in supplemental rations east of the Rockies.

However, after educating the 37 western congressmen as to the need for deeper cuts, PAW will still have to contend with other critics—those far-westerners in the Petroleum Industry War Council who fought nation-wide equalization of rations at the July meeting of the council with the contention that gasoline supplies in the area were still too far on the black side of the ledger to warrant such drastic action. But, the picture is rapidly changing, and these PIWC objectors will probably be brought into line.

Rep. Lea, California, chairman of the House Oil Investigating Committee, remarked to NPN that the justification for cuts in West Coast rations will probably be increased war demands from that area. If government officials here explain this successfully, the general public will accept further restrictions without too much fuss. He pointed out that consumption there is now well above local production. One answer might be to increase supplies of foreign oil—presumably from Venezuela by tanker through the Panama canal.

One other solution, the congressman pointed out, would be a crude price increase, but even this move would fail to show results for several months.

Congressional reaction to OPA's cut in "B" and "C" rations to a uniform value of 2 gallons East of the Rockies varied. Mid-western and southwestern congressmen reported wires pouring in registering strong protests, while eastern congressmen generally expressed approval, but asked further equalization in basic "A" rations.

Reports Mid-West In Arms

Rep. Brown, Ohio, said mid-westerners were "up in arms." He remarked, pointedly, that the Lea Oil Investigating Committee, of which he is a member, will start exhaustive hearings into all phases of the oil situation about Oct. 11 with Mr. Ickes and other PAW officials slated to be the first witnesses, followed by OPA, ODT, the Army and the Navy.

Senator Aiken, Vt., leader of the committee investigating the eastern gasoline situation as it hits farmers, said the action undoubtedly will please drivers in the East but thought it should have been taken a month ago.

Rep. Hartley, N. J., leader of an East Coast gasoline rationing bloc, said the cuts had brought about virtual equalization but that the inequality in "A" cards should be rubbed out as soon as possible.

Changes were announced by OPA at 7 P.M., Sept. 30 and were effective at 12:01 A.M. the next morning. At the same time, PAW announced that fourth quarter allocations had been set as follows: District 1, 379,000 b/d; District 2, 467,000 b/d; District 3, 145,000 b/d. Previous figures were 342,000 b/d in District 1, 480,000 b/d in District 2, and 140,000 b/d in District 3.

Summary of Changes

Summary of OPA's coupon changes follows: (figures are unit values except "A" coupons in District 1, where figures show number of gallons each "A" coupon is worth per week).

Region	Old Ration	New Ration
Districts 2 and 3		
"A"	3	3
"B"	3	2
"C"	3	2
N.C., S.C., Ga., and Fla.		
"A"	1.5	2
"B"	3	2
"C"	3	2
Northeast (12 states and D.C.)		
"A"	1.5	2
"B"	2.5	2
"C"	2.5	2

OPA said that despite a 25% cut in "A", "B" and "C" rations in the Mid-West and Southwest in August, consumption in the area had been running close to 75,000 b/d over the supply of gasoline allotted (480,000 b/d).

"Under these circumstances," OPA said, "there was no option but to cut civilians further. It is imperative that all water be squeezed out of supplemental rations and that 'B' and 'C' coupons in hands of motorists represent only the gasoline they actually need for occupational use. One way to do this is to reduce coupon values and make special provision for cases of extreme hardship, and we have decided this is the simplest, fairest way to meet the present problem."

In cases of "grave hardship", OPA continued, where there is also proof that car-sharing clubs cannot be formed or are operating at capacity and there is not adequate public transportation, local boards may issue additional "B" and "C" coupons, if necessary.

Validity Period Shortened

In the East, "A" coupon remains at a unit value of 3. gal., but the weekly worth of 1.5 gal. has been increased to 2 gal. by shortening the validity period during which coupons must last from Nov. 21 to Nov. 8. The eight A-8 coupons in the next book, now being distributed by local boards, will become valid Nov. 9, good for 3 gal. each through Feb. 8.

Although District 2 and 3 "A" coupons remain at 3 gal. weekly, one gal. must be used for occupational driving before motorist is entitled to supplemental "B" or "C" rations.

Out of the new allocations, Mr. Ickes said, amounts are first taken for the War Food Administration and Office of Civilian Requirements. The balance—350,000 b/d in District 1, 395,000 b/d in District 2, and 127,000 b/d in District 3—represents amount claimed by ODT for trucks, buses and passenger cars in the 3 areas.

He said:

"This is all of the gasoline that there

is for civilian use in this period after making provision for the present large and future increasing needs of the military. The allocations include amounts which the ODT has determined to be adequate to protect essential civilian uses to represent parity distribution of supplies between areas.

"In other words, the ODT has informed us by supplying to each district the amounts of automotive gasoline that we have certified, we are putting the motoring public in all 3 districts on the basis of equality, with the consideration given to differences in local conditions."

Mr. Ickes said PAW had not opposed suggestions that "A" coupon values be increased to 3 gal. in the East, nor did it urge "A" coupons be cut to 2 gal. in Mid-West. "Our responsibility," he pointed out, "is petroleum supply. We have met that responsibility by bringing about parity of distribution. It now is the responsibility of other agencies to determine how that supply is apportioned."

Calls 'Gas' Boost in East a Gold Brick

NPN News Bureau

NEW YORK—The new gasoline rationing plan lifting A-card amounts from 1½ to 2 gals. a week in District 1 is generally regarded here as a "gold brick" as far as Eastern drivers are concerned. William J. Gottlieb, president of the Automobile Club of New York and chairman of the Eastern Petroleum Consumers Council, said the reaction of thousands of members of the Council could be summed up in these words:

"The over-all supply of gasoline allocated for civilian consumption in the Atlantic Seaboard states represents practically no increase over the amount consumed in August and September. There is some adjustment of rations. Holders of A-books gain slightly to the extent of approximately half a gallon per week. This is a step in the right direction, but does not accomplish equalization.

"The recent squeeze on eastern "B" and "C" bookholders leaves little room for additional squeezing. The net result of the reduction from 2½ to 2 gals. in the value of B and C coupons here must result in application to local boards for additional supplemental rationing."

'Quota Fictitious'

The PAW certification for October of 379,000 b/d, which is termed a 10% increase over the September allotment of 328,000 b/d, actually represents no increase at all, several distributors here argued. For while September quota was 328,000 b/d plus 14,000 b/d for restoration of bus and taxicab service, actual consumption in the district was 378,000 b/d. Much of the September "overdraft" of gasoline, it is pointed out, was purchased through the black market. Some motorists contend they were forced to patronize the black market in order to meet minimum transportation needs.

'No Need for Juggling'

The new allocation, one distributor said, shows that OPA and PAW acknowledge that the demand is legitimate and "that a sufficient supply is available to meet this demand and there is no necessity for coupon juggling in order to balance supply and demand."

The new program is not really equalization at all, many say, because while in the East the basic "A" ration is 2 gals., in the West 3 gals. will be delivered, one of which is for occupational travel. The question is raised: "What happens to this extra gallon when there is no occupational driving?"

Mr. Gottlieb holds that the new plan "means nothing in gasoline savings."

"OPA has never been able to police gas consumption in the Mid-West or Southwest," he says. "Western motorists still enjoy a basic A-ration 50% higher than Easterners. Why continue this sectional discrimination and then claim equalization?"

It is pointed out that PAW has admitted that consumption in the Mid-West and Southwest has exceeded allotment by 75,000 b/d. It is also argued that petroleum products for military purposes will be drawn from the East, and hence larger stocks should be built up here.

And while OPA calls the increase a 2-gal. a week allotment, the driver who actually uses 2 gals. a week will find himself out of gas before his next coupons become valid. This results from the fact that OPA has established rationing periods of 3 (formerly 4) months each, while issuing coupons to cover only a 12-week period (formerly a 16-week period) at the stated weekly allotment. An A-8 coupon, valid Nov. 9, will be good for 3 gals. each (24 gals. total) for the 3 months ending Feb. 8. But since there are 13 weeks in that period, the ration really is not 2 gals. a week.

PAW Erases Last Reminders Of '41 Shortage in East

WASHINGTON — Revocation of Recommendations 1 and 3 removes from the books of PAW two of the last reminders of the 1941 East Coast shortage.

Issued in September and August 1941, respectively (recommendations weren't issued consecutively back in the early days of the Ickes oil organization), Recommendation 1 requested a 33-1/3% cut in District 1 gasoline consumption, while No. 3 called for a reduction in mileage by commercial vehicles engaged in nonessential activities.

OPA's Coal Conversion Program All Over, But Don't Reconvert

WASHINGTON—The last remnants of the oil-to-coal conversion program went over the dam Oct. 1 with the announcement by OPA that fuel oil rations will be granted to consumers using more than 10,000 gal. annually regardless of whether their equipment can be converted to the use of coal.

On Aug. 24, OPA had announced that all buildings using less than 10,000 gal. for heating purposes in 1942-43 would receive their 1943-44 fuel oil allotment regardless of whether their burners were technically convertible to coal. OPA's latest action removes all conversion requirements on buildings whose equipment used more than 10,000 gal. of fuel oil during the last heating season.

Coal Stringency Is Factor

A number of factors entered into the decision to end the conversion program, according to OPA. "These include a slight improvement in the oil supply, a dropping off in the coal supply, and the conversion of enough equipment from fuel oil to coal to effect an annual saving of about seventy million barrels of fuel oil.

"Although the fuel oil situation remains serious, the supply of coal is at a point where the short supplies or both, in relation to existing heating squipment, are in balance. In this situation it is desirable to suspend the program of converting equipment from oil to coal."

In general, OPA added, it will not be easier to buy fuel oil than coal this winter in the ration area, "and therefore it will not be to the advantage of a consumer who has converted from oil to coal to reconvert back to oil."

Fuel oil rations will not be issued, OPA said, except in "extreme hardship" cases, for equipment reconverted from coal to the use of fuel oil. OPA district directors must approve all applications for heating oil to supply altered equipment from users who contend they will suffer unreasonable hardship unless the ration is issued.

Must Complete Conversion

Although all consumers will receive fuel oil rations for 1943-44 regardless of convertibility, users are not eligible for an oil ration this year, if, by Sept. 24, substantial work had been done to alter their equipment or if by that time conversion of the equipment had already been completed.

First relaxation of restrictions which limited issuance of rations to consumers able to convert to coal came last May 10. At that time, OPA announced the removal of all "convertibility tests" for obtaining supplementary heating rations in the 33 eastern, mid-western and Pacific northwestern states under fuel oil rationing.

The Week's Orders

(Issued Sept. 25-Oct. 2, Inclusive)

PAW—Petroleum Administration for War
- PAO 5, as am. 9-24-43—District 1 shipments
- PAO 5, Deleg. of Auth.
- PAO 16 (Old M-188)—Sulfonates
- PAO 17 (Old L-70)—District 1 deliveries
- PAW, Dist. 2 Telegram Directive, 8-23
- PAW, Dist. 2 Telegram Directive, 9-30

OPA—Office of Price Administration

Prices
- RPS 88, Am. 129—Oil burner services
- MPR 134, Am. 12—Rented machinery
- MPR 136, Am. 100—Machines and parts
- MPR 165, Supp. Serv. Reg. 19—Oil burner repairs
- MPR 453, Am. 1—Notification provisions
- GMPR, Rev. SR 11, Am. 36—Contaminated petroleum products
- GMPR, SR 15, Am. 10—Deleg. of authority

Licensing
- SO 72—General license
- Licensing Order 1—General
- Licensing Order 2—Scrap dealers
- Licensing Order 3—Second hand parts

Rationing
- RO 1A, Am. 50—Automobile dealers' tires
- Am. 52—Grade I tire restrictions
- RO 5C, Am. 74—Rental vehicles' rations
- Am. 75—C rations, armed forces
- Am. 76—Renewals of rations
- Supp. 1, Am. 9—Coupon value reductions
- RO 11, Am. 81—Idaho space heaters

WPB—War Production Board

L Orders
- L-51—Anti-freeze
- L-70—Revoked
- L-79—Stoves
- L-199—New hot water tanks
- L-211—Oil country tubular goods

P Orders
- SO P-135-A—Reagent chemicals

R Orders
- R-1, Am. 4—Rubber cement

Priorities Regulations
- Pri. Reg. 3, Am. 2—Laboratory equipment

ODT—Office of Defense Transportation
- GO ODT 21, Am. 9—Certificates of war necessity
- AO ODT 5—Certificates of war necessity
- AO ODT 6—Division of Motor Transport
- AO ODT 8—Appeal from certificates of war necessity

WLB—War Labor Board
- GO 4—Wage increases

Executive Orders
- E. O. 9381—Wage decreases

Digest of Week's War-Oil Orders

Petroleum Administration for War

PAO 5, as am. 9-24-43—Shipment of all principal petroleum products into District 1 subject to approval of District Director in Charge. Included are automotive gasoline (aside from war products), kerosine (including range oil, stove oil, and No. 1 distillate fuel oil), distillate fuel oil (including light gas oil and light and heavy Diesel fuel oil), and residual fuel oil and crude oil for non-refining purposes. Shipper may not forward until he receives written evidence of issuance of approval. Government agency consignments exempted. District 1 original suppliers shipping under PAW schedules issued pursuant to Dir. 59 (pooling of supplies, with pro rata share to each supplier) are not affected by this order unless total of all deliveries of each product received during month by original supplier exceed supplier's monthly quota. Shipments qualifying under Dir. 59 rules may be made to any purchaser upon his statement that they are authorized by PAO 5, paragraph (c). Issued 9-24, effective 10-4.

PAO 5, Deleg. of Auth.—Deputy Administrator Davies authorizes Director Dodge, District 1, to grant or deny, in whole or in part, applications for approval specified above. Approvals to be based on proof furnished of maximum efficiency in use of transportation facilities, of shipment's essentiality for military, industrial, or civilian requirements, of effecting more equitable distribution in an area, and of DSC's receiving the price increases permitted by OPA to offset increased transportation cost. Clearance of approvals must be obtained from Director of Petroleum Supply, Washington, and all documents to be submitted to District 1 Counsel, for review and approval as to form. Issued 9-29.

PAO 16—Old M-188 reissued as PAW order. Allocation of petroleum sulfonates substantially unchanged. Five copies of same forms (now WPB 2945 and 2946, formerly PD 600 and 601) to be filed with PAW instead of WPB. Issued 9-29, effective 10-1.

PAO 17—Former L-70 reissued as PAW order. Sections prohibiting motor fuel shipment from Washington and Oregon eliminated. Phohibition of District 1 deliveries to points outside District 1 retained. Issued and effective 9-29.

District 2 PAW Telegram Directive, dated 8-23-43, requires each oil company to ship additional amounts of gasoline into District 1. Issued 8-23, effective 8-24.

District 2 PAW Telegram Directive, dated 9-30-43, cancels the above directive, effective 10-1. Allocations made by Director in Charge, and still undelivered by company receiving requisition, must be shipped this month. Issued 9-30, effective 10-1.

More War-Oil Orders On Page 37

Office of Price Administration

RPS 88, Am. 129—Oil burners services, if heretofore rendered without charge, may now be charged for on basis of ceiling permitted by MPR 165 (consumer service price regulation), without lowering the fuel oil ceiling established in RPS 88. Issued 9-24, effective 9-23.

MPR 134, Am. 12—Settlements for damage done rented construction and oil field machinery shall not exceed maximum (as of time of damage) set by MPR 136. Not applicable to insurance company settlements. Usual adjustable pricing provisions added by this amendment. Issued 9-24, effective 9-30.

MPR 136, Am. 100—Adjusts, upon OPA written approval, inequitable prices resulting from base date ceilings of machines and parts, by new rule permitting multiplication of such base date selling price by a fraction having supplier's base date price as numerator and actual cost on which seller calculated his base date selling price as denominator, i.e. mark-up permitted proportionate to supplier's price increase. Issued 9-28, effective 10-4.

MPR 165, Supp. Serv. Reg. 19—Hourly rates for maintenance and repair of oil burners set at $2.50 first hr. and $1.75 succeeding hrs., in cities of 500,000 population or over; $2.00 and $1.50 in cities of 100,000 to 500,000; $1.50 and $1.25 in cities under 100,000, inclusive of mileage and all other charges. Servicers with properly established higher rates must post conspicuously in their establishment a duplicate of the statement filed with their local price and rationing board, with filing date shown. Other servicers with higher rates must file statement with local board by 11-1-43, giving supporting data for such rates, or reduce them to ceiling after that date until such a statement is filed and accepted. Per-call basis charges having ceiling above first-hour rate may be retained, if statement has been filed with OPA under MPR 165, or charges may be converted to hourly basis at permitted rates and ceiling established therefrom. Suppliers not so registered must do so by 11-1, in same manner as described for hourly rates. Rates below ceiling or free maintenance services may be changed to hourly ceiling. Issued and effective 9-23.

MPR 453, Am. 1—Wholesale and pick-up sale notification provisions changed to permit wholesaler's statement of ceilings *to other wholesalers* on either invoices or, with certifications on price lists, discount sheets, or catalogs furnished to customer not already supplied with them. No change in requirement that wholesaler selling to retailer state ceiling on invoice or sales slip. Pick-up sales between wholesalers require retail ceiling statement on invoice or sales slip after 10-31-43, and pick-up buyer adds his normal mark-up for same type part. No changes in non-list parts regulations. Issued 9-27, effective 10-1.

GMPR, Rev. SR 11, Am. 36—Reconditioning of contaminated petroleum products from ocean-going vessels is exempt from price control. Issued 9-28, effective 10-4.

GMPR, SR 15, Am. 10—Region IX Administrator may confer any of his powers on the Territorial Directors in the settlement of applications for price adjustment. Issued 9-27, effective 10-2.

SO 72—Licenses all persons selling commodities under price control. Among price schedules to which licensing provision is added are: 28 (ethyl alcohol), 53 (fats and oils), 121 (solid fuels, producers) 122, (same, dealers) 131 (camelback), 134 (rental oil field machinery), 323 (asphalt). Replaces licensing provisions in numerous price orders, including RPS 88 (petroleum products), MPR 436 (crude petroleum, petroleum, and natural gas), and MPR 137 (service station prices). Issued 9-27, effective 10-1.

Licensing Order 1—License required of, and automatically granted to, all persons making sales of commodities and services under price control. Continues in effect all former suspensions and does not prevent prosecution for violations of previous licenses. Government agencies, as well as farmers and fishermen selling own produce, excepted from license requirements. Issued 9-27, effective 10-1.

Licensing Order 2—New dealers in waste, scrap, and salvage material, including licensed dealer opening new place of business, required to register with OPA within 5 days of first sale. License continued, by Licensing Order No. 1, for dealers already registered under Supplementary Order 5. Issued 9-27, effective 10-1.

Licensing Order 3—Requires registration with OPA of all new non-retail dealers in second-hand machines or parts within 5 days of first sale. Re-registration of dealers registered under Supplementary Order 20 unnecessary. Issued 9-27, effective 10-1.

RO 1A, Am. 50—Automobile dealers may secure, by application on Form OPA R-1, Revised, Grade III tires or new tubes for cars held for resale if old ones not repairable, or if car lacks number of each permitted by OPA. Switching of tires or tubes between cars not permitted. Scrap tires replaced by Grade III tires in dealer's stock must be tagged with date and serial numbers of tire and of replacement certificate. Issued 9-27, effective 10-1.

RO 1A, Am. 52—Eligibility for Grade I tires restricted to persons permitted 601 or more miles per month. Grade III tires and new tubes available to persons allowed over 240 miles. Persons with mileage allowance under 240 allowed new tubes, but Grade III tires only if vehicle used for occupational driving. Issued 9-25, effective 10-1.

RO 5C, Am. 74—Rental vehicles not eligible for occupational mileage unless held for 30 days, and rental rations may not be used for longer than 30 days. No ration allowed which permits a vehicle not entitled to a certificate of necessity to be moved on its own wheels over 200 miles, unless ODT certifies it to be a commercial vehicle lacking adequate substitute means of transportation, thus prohibiting movement of vehicle over 200 miles for delivery after transfer of ownership, unless transport of basic ration has been issued for use with it. Movements between plants assembling vehicles exempted. Issued 9-27.

RO 5C, Am. 75—"C" ration applications by members of armed forces for travel to and from post of duty must be certified by official in charge of any organized transportation plan

(Continued on p. 37)

The Editor's Page

Cooperation of Oil Men Causes 'Bureaucrat' To Replace an Order with Voluntary Effort!

A "BUREAUCRAT" has just made a new all-time record for bureaucrats. He cancelled a directive which had only been in effect 37 days, because, by that time, enough citizens had indicated that they were going to carry out the idea contained in the directive. The "bureaucrat" figured that inasmuch as the citizens seemed to have caught the idea of the directive it wasn't necessary for the government to crack the whip over them any more.

The "bureaucrat" in question is PAW director Vandeveer for District 2. The directive was his order of Aug. 23 specifying additional requirements of 50,000 b/d of gasoline for the East Coast. Cancellation of the directive came Sept. 29.

Never in the history of the New Deal's administration of this war have we heard of a bureaucrat withdrawing a directive, at least not till long after it was useless. Nor have we ever heard of a bureaucrat withdrawing a directive before it had been fully complied with. In this case those who had not yet been able to comply had satisfied PAW Vandeveer they would or make up their quota in October.

The cancellation of this directive carries out the often-made statement of District 2 Director Vandeveer, as well as statements of others of PAW, that PAW wants only to help the industry do a job and does not want to involve government in the oil business any more than is absolutely necessary. Mr. Vandeveer's cancellation of this directive shows that he meant just what he said as to wanting to keep out of the other man's business, just as the issuance of the directive also proves that he meant what he said, that the circumstances were such that the East Coast simply had to get the extra motor fuel, and if it didn't the industry would get a directive, much as he didn't want to give it.

One can't blame businessmen and oil men for being skeptical of even the best of men on war agencies. The confusion in Washington and the mismanagement from the White House down has made it necessary for every man to be on guard for his own interest or be robbed not only of his businesses but of his rights by some of the ultra reforming bureaucrats.

But, PAW and recently District 2 Director Vandeveer have shown that they are working for the best interest of the oil industry, being oil men themselves, and that they are giving the oil industry every opportunity to cooperate in the making of their decisions. Hence, any skepticism as to the intelligence, fairness and the point of view that the average man has against all Washington, is not justified against PAW.

When an order is issued by PAW, or even a request is made, every oil executive should see that it is clearly understood by his associates and intelligently and fairly as well as promptly carried out. From time to time there is evidence of operating men even in rather high positions in major oil companies, "fudging" on PAW directives and even on cooperative oil industry operations. This is undoubtedly due to the high competitive spirit carried over from the past.

One top oil executive of a very large company said to the writer just the other day that one of his great problems, and problems of other top executives, was to contend with the results of years of training of their men. He said that since the organization of the company the employees had been taught to fight hard for every gallon and every penny and every bit of commercial advantage. Now, he says, it is necessary for major companies particularly to give, to be generous, to lean over backwards in their consideration and cooperation even to competitors as well as to the government.

This need for putting commercialism second, he said, calls for a changing of the human beings that they have been training all these years. The result is, he declared, unfortunate decisions are often made down the line by men who don't interpret as applying to their day-to-day business actions, the broad cooperative spirit that is necessary to win the war.

This explanation aptly describes the attitude of some oil executives which first brought the refinery allocation directive from PAW Director Vandeveer. It also describes the opposition when Mr. Vandeveer insisted at several committee meetings of the past few weeks, that since the independent refiners were prevented from bidding for crude in the independent market and were prevented from drilling for crude the companies with crude must share reasonably with the refiners who have no crude and that all companies equalize their output with their own stations, their own customers and their competitors.

This failure on the part of some oil men to recognize the changed conditions due to the war is also responsible for decisions that were made by some men in large companies when Mr. Vandeveer announced cancellation of his directive. Several recipients of the cancellation evidently didn't read it correctly, others seemed to think that all bets were off and they could do as they pleased.

Here is another management job for top executives whose task it is to see that every officer and employee has a friendly cooperative spirit else they invite more government interference.

All this is a great opportunity for the oil industry to do some real cooperation under the auspices of PAW. In a few words at a recent meeting with marketers at Des Moines, Ia. PAW Director Vandeveer said:

> "Many people have come to lean upon government as a crutch. But, gentlemen, a crutch is for the sick, the old or the infirm—the marketing branch of the petroleum industry is none of these. . . . .
>
> "If a regulation is needed what would be a most practical approach to the problem? Would you want a Federal directive that would apply to this section as well as all other sections of the country? Or would you prefer a locally-inspired ordnance or policy developed from a mutual understanding by local marketers—a solution that is proposed locally and enforced by your own people?
>
> "Let us not lean unnecessarily upon government lest we forge for ourselves a "ball and chain" as a business ornament in the postwar days to come. Rather, let us create the kind of sharp clear-cut thinking that will permit us to cut through local problems and handle them right where they develop."

All that calls for a clear understanding and full realization that orders and policies are to be interpreted and carried out for the best interests of the country and the war.

READERS' comments and opinions will be much appreciated by Warren C. Platt, NPN's Editor and Publisher, Penton Building, Cleveland 13, Ohio.

Experts (?) Fool with Shortage but Avoid Course That Will Get Oil

WHEN THE OIL EXPERTS (?) of the White House last week decided to make the B and C coupon holders walk a bit, the record does not show that these experts (?) did anything at all about getting more oil.

Perhaps President Roosevelt read to them again the excerpt from his recent broadcast in which he assured the public that under his administration and since "the outbreak of the war in Europe," which was in 1939, "we have increased our output of petroleum by 66%." If so, maybe the White House experts who cut the coupon values decided to believe him even though we are not within 2,500,000 bbls. a day of the Roosevelt figure.

Incidentally, the identity of the man who concocted this bare falsehood other than the one who spoke it, never has been disclosed, nor has the "authority" on which the falsehood might be based been identified.

No one will quarrel with the authorities for tightening up on the B and C coupons, providing some ration boards do not undo it with the favoritism and mishandling that over-issued the allotted gasoline supplies in the first place, and provided also the ration boards do an intelligent job of giving more coupons to those who actually need the gasoline.

Nor will any one quarrel with the authorities for trying to get more oil out of South America for this country, when we are this short and that is the nearest place to get it. Nor can one object to a policy of conserving our oil supplies, as was recommended by the Economics Committee of PIWC months ago, and causing our war allies to draw on foreign supplies.

But the people of this country can, with full justification, ask why they cannot be allowed to get more of their own oil out of the ground, for their own use, while oil from nearby and other countries is delivered to the war fronts?

This week at Washington a conference talks of bringing oil from Venezuela through the canal to California next year to try to offset a growing shortage there. The same submarines with the new type attack that inflicted heavy losses on a big convoy at sea last week, as the submarines were released with their new equipment, probably can find their way to the Caribbean and again enforce a complete naval blockade of our coasts.

So once more with the ever growing military demand for oil, increasingly precious time is being lost by Roosevelt dallying over what today is the most vital of war munitions.

The Roosevelt henchmen who probably never saw an oil field, still talk about there being as many wildcat wells being drilled today as in the past, and that a subsidy is the best way to handle the extra cost beyond present wildcats. While the number of wildcats is also subject to question the fact is evident that there are not enough wildcats being drilled. To get that required number, whatever it may be and no one knows, miles and miles of red tape, will have to be unravelled if we go the subsidy route.

But to get that required number if the country goes the route which has always gotten the oil in the past, a sufficient price, will take only long enough to get out the extra tools, for the factories to make a few more rigs, recruit the men and go to spudding in.

If the government allows a higher price for the crude more than 30% of it will be paid today by the government direct in its purchases of petroleum, and more than 40% by next year. Indirectly the government will pay through munition plants, transportation etc., probably as much more or perhaps 75% to 80% of the price on all crude produced. Then the "poor wage worker" who is making more money than he ever did, will be asked to pay perhaps $7 a year more if crude goes up $1 a barrel and he rides in his car all alone, or only $1.40 more a year if he shares a ride with 4 of his fellow workers.

This, the White House authorities say, echoing their nemesis John L. Lewis, is "inflation."

The question keeps rising in one's mind: Do Roosevelt and his professors and lawyers really know what they are doing in regard to oil?

Congress might put all the White House experts (?) on the stand next. Or call on John Lewis to see if he honestly thinks that $1.40 more a year paid by the war-paid worker is really "inflation."

Maybe John could get us permission to drill in our own yard for our own oil to keep warm this winter and maintain the essentials of our own system of transportation?

Career of Veteran Refiner Proves Strength Of Independents and Freedom of Opportunity

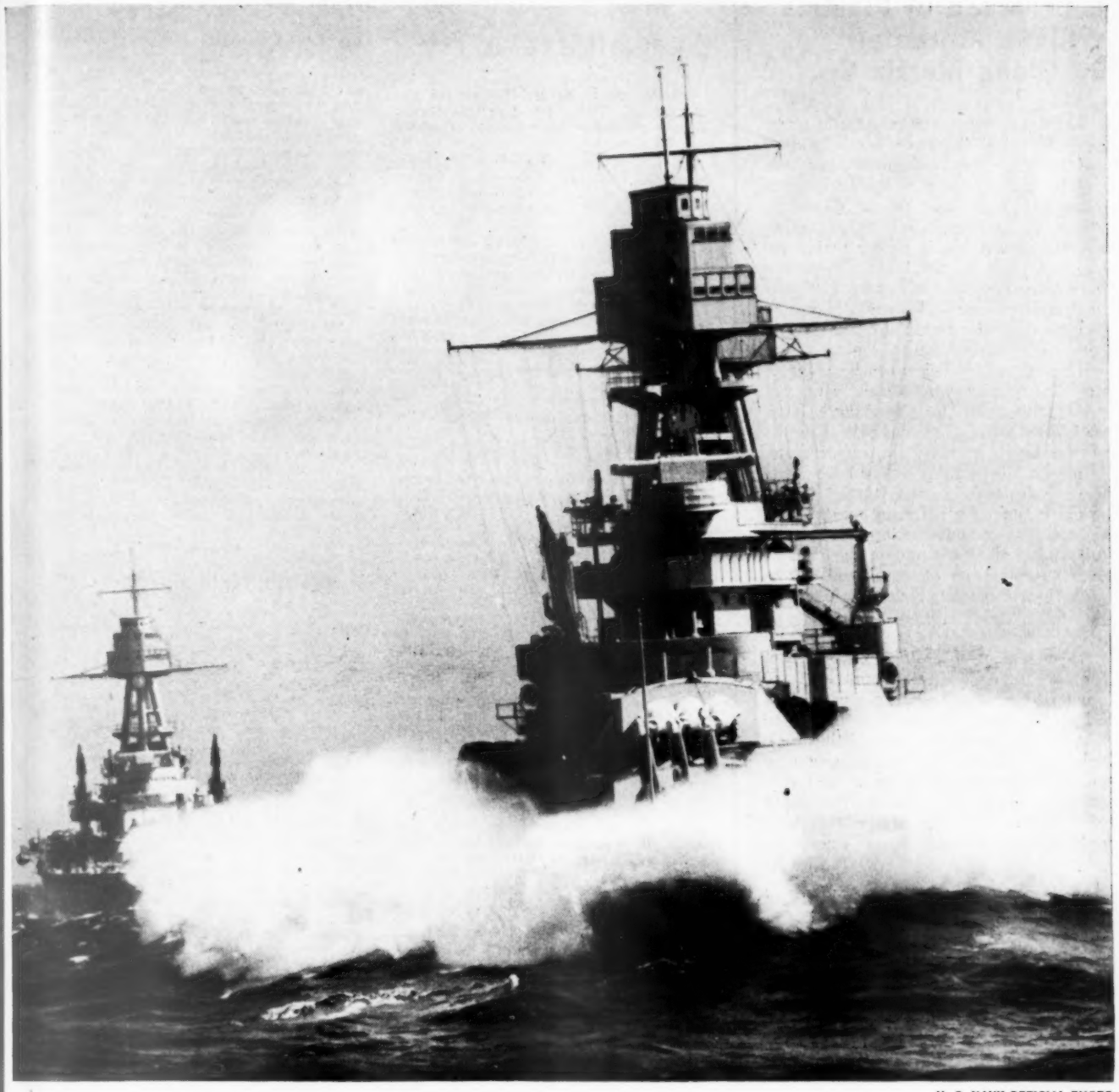
A STRIKING EVIDENCE of the strength of the independent oil industry is the life of the late Charles C. Stoll, of Louisville, Ky. For 47 years he was an independent oil man.

Like so many thousands of independent oil men in producing, refining and marketing he began at the bottom with nothing but a shoestring, ability and a willingness to work long hours. In short, his start was with a one-mule tank wagon route and he drove the mule himself. When Mr. Stoll died last month, he left a most sizable business that is still independent. It is a refinery with producing properties and a large marketing business in the Louisville area. Mr. Stoll also was considerably interested in other independent refining and marketing enterprises that he had helped with his money and advice to grow to large size.

One reason we know why there are not more old independent oil companies these days, is because so many of these companies were built by strong individuals, who, unfortunately, had no sons or organizations to whom to leave the business. Security in their later days against the extreme hazards of the oil industry has caused many an oil man to sell out to the larger companies. In the case of the late Mr. Stoll, he had no occasion to sell because he has 4 boys, all of whom became active in the business as they grew up and the four are carrying on now that the father is gone.

Mr. Stoll built his independent oil business by hard work, sound judgment and by plowing in the profits. During more than half of his life there were no income taxes, personal or corporation, so he had full opportunity to put the profits back into the business. This he did and a strong business resulted. Unless Congress changes its anti-capitalistic laws it will be most difficult if not almost impossible, for any Mr. Stolls of the present to develop similar businesses in the next 47 years, because for the last dozen years or so the government has been more and more blocking the growth of small independents in any business by taking nearly all of their profits which they otherwise would use in developing their business.

All oil men should drive home to their congressmen that the contribution to American business and American life made by Mr. Stoll cannot be duplicated by those who would follow in his footsteps unless Congress puts a premium on hard work, intelligence and sound business management, by further changing its tax laws to show that it surely wants to build independent businessmen rather than create large business monopolies.



U. S. NAVY OFFICIAL PHOTO

The Fleet can't fight with firewood

THE ENEMY IS SIGHTED!

Destroyers boil on ahead . . . cruisers wheel around into battle line . . . the big battlewagons quiver with furious power as they slash through the seas under a full head of steam.

Four days later a communique says: *"A task force under Admiral Blank contacted the enemy last Thursday. During a three-day-running engagement, our forces scored a decisive victory, sinking five enemy vessels and damaging three more."*

The communique might also say: *"In winning this engagement, our forces burned enough fuel oil to heat a whole town for a year!"*

This War is an Oil War

The amount of fuel needed by our Navy is tremendous.

But so is the amount of lubricating oil, turbine oil, greases, rust preventives, and hundreds of other petroleum products.

The American petroleum industry is producing and delivering these essential war materials, not only for the Navy, *but for all the armed and home-front forces.*

It is gratifying to Gulf to know that the extensive program of constant product improvement carried on in peacetime is enabling us to serve the United Nations better by producing better petroleum products for war.

GULF OIL CORPORATION
GULF REFINING COMPANY

DETROIT PUBLIC LIBRARY

Tube Made of Plastics Will Be Marketed by Glenn Martin Co.

Special to NPN

BALTIMORE — Elasto-plastic tubes for tires, surgical gloves, bottle nipples and other rubber-substitute products will be manufactured immediately on a mass-production basis by the Glenn L. Martin Co., Glenn L. Martin, president, has announced at his offices here. An idle tire plant in the Middle West has been converted into a factory for making the new material, known as Marvinol, a substance developed by the Martin company's own chemists.

Tires as well as tubes can be made of the new plastic, Mr. Martin said, but present plans call for no output of tires until after more is known of the results of the huge synthetic rubber program. Furthermore, he said, the current shortage is more in tubes than tires.

The company is weighing two plans—to continue manufacturing the plastic tubes after they are put on the market, or to license other plants to make them under patent grants. However, Mr. Martin said: "We hope to have a tire department soon."

Development of Marvinol and the plan for its commercial production were announced by Mr. Martin at the company's bomber factory and newsmen then were taken on an inspection tour of the F. G. Schenuit Rubber Co. plant, scene of much of the experimentation, and witnessed a demonstration of the processing of Marvinol from the crude state to a finished inner tube.

Cost Is 29c Pound

Displayed were inner tubes which had been run 8000 miles on factory tests. For that distance no air had been added and no seepage recorded. The tubes showed no signs of wear.

Present cost of Marvinol manufacture is 29c a lb. on a laboratory basis.

One feature of the process is that production can be made with the same machinery used in the making of gum rubber tubes, with certain slight modifications. Vulcanizing, a process which required 7½% of the total time in the manufacture of gum rubber tubes, is eliminated.

Another important factor is that Marvinol is 100% reclaimable; damaged or deteriorated tubes are fed directly in with the new raw material for reprocessing.

Basic ingredient of Marvinol is vinyl-type plastic.

So far inner tubes have been made for passenger cars only, but larger tubes will be made immediately. Martin officials claim the tubes are superior to those made of natural rubber. And the surgical gloves made of it are said to be more resistant to acids and alkalies than natural-rubber gloves.

The process hinges on the "plasticizer" which is non-extractable from the plastic, enabling it to resist air, water and sunlight, acid and alkaline solutions and temperatures up to 250 deg. F. and still retain elasticity, resiliency and flexibility.

Letters from NPN Readers

Questions for Davies

FROM: G. L. Savory, Savory Oil Co., Binghamton, N. Y. TO: Ralph K. Davies, deputy petroleum administrator, Washington, D. C.

On August 18th you made the following statement. "Civilian consumption on the East Coast is running higher than the current allotment and the available supply is being substantially overdrawn."

Because of the fact that all gasoline for civilian consumption is being distributed by your agency through the Supplies and Distribution Committee, I would like to know the answers to the following questions.

How can the supplies be overdrawn when each oil company's allotment is established by your agency and they are told where they must obtain the products?

How can the allotments be overdrawn when we are only receiving 75% of the allotments that were established for us for the month of August?

Who is obtaining this gasoline that is being overdrawn?

You specifically state that it is civilian stocks that are being overdrawn. This would eliminate the argument that military supplies are the reason for the present critical shortage of gasoline. OPA General Mg'r. Bowles in his radio address Sunday night, August 15th said: "Now, thanks to the efforts of Mr. Ickes and Mr. Eastman, our eastern shipments of petroleum products have reached a total in excess of 1,400,000 b/d. The improvement in our transportation situation has made it possible to increase the daily gasoline shipments to the eastern seaboard."

As I interpret your statement, after giving the facts in the above paragraph consideration, this overdrawing is being done right in the pool over which your agency has complete authority. In other words the small independent jobber, like myself is being made to give up a part of the allotment that he is rightfully entitled to because someone in the pool is getting more than their share. It would seem that the black market is functioning very nicely for someone right inside your own agency and the small independent jobber is the victim of it.

Answers Reader's Questions

FROM: John Harper, District 1 PAW marketing director. TO: G. L. Savory, Savory Oil Co., Binghamton, N. Y.

Your letter of August 19th to Mr. Davies has been referred to me for reply.

I appreciate the fact that on the surface the facts are not consistent with the statement which you quote. The apparent inconsistency stems, I think, from Mr. Davies' use of the words "allotment" and "overdrawn."

The "allotment" he was talking about was the certification of gasoline to the OPA, ODT, and other government agencies. That is the amount which PAW estimates will be available for use and represents the allowable consumption figure based upon the forecast of supplies and the necessity for building up inventories. Having certified that figure, PAW has little more to do with seeing to it that consumption actually stays within the certification.

The allocations to the original suppliers by the Supplies and Distribution Subcommittee, however, are determined by the actual available supplies from day to day. They have no direct connection with the certification figure, but are determined by the actual total available supplies which may be and often are larger than the certification. This is true because stocks of gasoline are, as you know, far below safe operating levels, and the "total available supplies" which are allocated include amounts that should be added to inventories rather than distributed to consumers. If consumption were held to the certified amount, the excess of available supplies would be added to inventories.

However, there is no way that the PAW can limit sales to see to it that no more than the certified amount is used. All available supplies must be distributed to meet current rationed demand as evidenced by coupons, up to the limit of the available supplies, even though this demand is greater than the PAW certification. Therefore, it is perfectly possible for consumption to exceed the certification, as Mr. Davies reported it has during the past month or two, and still have actual deliveries to suppliers at less than the originally allocated amount. These reduced allocations may be, and often are, still more than enough to give the public the total amount promised or certified by PAW.

Mr. Davies was not talking about any overdrawals by oil companies, but about the over-consumption by motorists. With supplies short to begin with, it was inevitable that as soon as the public began using more gasoline than the PAW certified, this over-consumption was reflected in rapidly declining stocks and the resultant local shortages.

This, of course, is a general statement applying to the entire East Coast. If you wish any specific information, I will be very happy to talk with you when you are next in New York.

Applauds NPN Editorials

FROM: R. R. Pierce, Continental Petroleum Corp. TO: The Editor.

The Editor's Page, with reference to the manner in which the oil and petroleum business in its general phases is being conducted by the inexperienced "high-ups" in Washington, has been carefully read and noted.

This article should be in the hands of each and every person interested in the welfare of this country in its general position as all of the matters that are being handled through Washington are in the identical position the oil and petroleum business is in. It is commendable to know that one of the important matters has been placed in a position where it can be presented to the public in the manner this particular commodity has been, and all others should be singled out and placed before the public in individual positions as this has been.

The truth and the facts the public gets through news and radio mediums does not provide them with information on which they can form opinions and arrive at any definite conclusions. The manner in which this has been defined to its individual and particular subject is the type of information the public needs and is desirous of having, and if they could be supplied with all of the facts pertaining to all matters in a defined manner, some of the conditions that exist would be corrected.

You are to be commended for the effort you have put forth with an endeavor to assist in causing a serious condition to be understood by the people at large.

I should be glad if it were possible for reprints to be furnished to distribute at my personal expense as many as possible, believing it to be an important matter to be considered by the public at this time.

Likes NPN's New Dress

FROM: Ralph C. Champlin, Ethyl Corp. TO: The Editor.

Do not think that I haven't noticed the many changes and improvements which you have made in N.P.N. in the past months.

That you credit me with any authorship of suggestions is flattering, but I do believe that we discussed some of these things and to my way of thinking, the typography, make-up and readability is better now, even in the smaller size, than before.

Any way you measure it...

Houdry is First!

FIRST IN OPERATION

Commercial Houdry units were on stream when other catalytic cracking processes were still "on blueprints." Houdry Process is the *only* catalytic cracking process which has proved its worth both for war and peace.

FIRST IN NUMBER OF UNITS

Twenty out of the twenty-four catalytic cracking units producing aviation gas are Houdry units. They operate dependably around the clock and across the calendar. Thirty-nine more Houdry and Thermofor Catalytic Cracking units are under construction.

FIRST IN VOLUME

During the first twenty months of war, more than 90% of *all* catalytically cracked aviation gas for the United Nations has been made by the Houdry Process.

FIRST IN INDUSTRY FAVOR

The sixteen companies licensed by Houdry include most of the best known names in the petroleum industry. They represent more than 50% of the total refining capacity of the United States.

★ ★ ☆

The farsighted refiners who first adopted the Houdry Process in order to produce better motor gasoline were in the best position to get into war production of catalytically cracked aviation gas. They will be equally prepared for peace—with the only catalytic cracking process that has proved its ability to meet commercial *and* military requirements.

Houdry Process Corporation, WILMINGTON, DELAWARE

Houdry Catalytic Processes and the Thermofor Catalytic Cracking Process are available through the following licensing agents to all American refiners, subject to approval by the U. S. Government.

E. B. BADGER & SONS CO. Boston, Massachusetts • BECHTEL-McCONE-PARSONS CORP. Los Angeles, California • THE LUMMUS COMPANY New York City, New York

HOUDRY CATALYTIC PROCESSES ... FOR VICTORY IN WAR ... FOR PROGRESS IN PEACE

Dist. 5 Civilian 'Gas' Quality Cut

PAW Acts to Increase West Coast Stocks of Military and High Octane Fuel; Order May be Made Nationwide Later

NPN News Bureau

WASHINGTON—Citing the urgent need to increase output of military aviation and 80-octane military gasoline, PAW has issued an order to District 5 refineries sharply reducing yields of premium grade automotive gasoline and establishing controls over A.S.T.M. distillation range of all civilian automotive gasolines.

It was reported that similar action may be taken nationwide later and tightened up progressively, perhaps even to the extreme of permitting only one grade of civilian gasoline.

Although announced here Oct. 1 by PAW Ickes, notice to West Coast refiners went out Sept. 24 through the following telegram from Refining Director E. D. Cumming to District 5 Director Herbert Gallagher:

You are hereby authorized and directed to issue directly or through the district director of refining operating instructions to all refineries in District 5 directing them to maximize production of 87-octane number or higher aviation gasoline and base stocks and of 80-octane military gasoline. These instructions should be issued by telegrams signed "Petroleum Administration for War by Herbert R. Gallagher, director in charge, District 5" or the same by Malcom B. Youker, District director of refining, District 5, and should be in the following form:

"The urgent need to increase the outturn of military aviation and 80-octane number all purpose gasoline required an immediate increase in their production. Because requirements for these gasolines must be fulfilled you are hereby directed to utilize all straight run fractions thereof capable of being used in manufacturing 87 or higher octane number aviation gasolines or base stocks for the production of the maximum quantities of such gasolines or base stocks. All fractions or potential fractions capable of producing 80 octane number all purpose gasoline Army Specification 2-103A as revised, but not suitable for use in aviation gasolines or base stocks must be utilized in the manufacture of maximum quantities of the 2-103A grade. As you know the octane numbers indicated are those resulting from the addition of the maximum permissible amount of tetraethyl lead to clear petroleum products.

"In connection with the above you are directed to control the A.S.T.M. distillation range of all civilian automotive gasolines blended or otherwise produced so that the temperature in degrees Fahrenheit at which 10% and 50% are evaporated shall not be lower than 150 and 260 respectively.

"You are further directed to limit your production of civilian automotive gasoline having an octane number above 74 CFR to not more than 10% by volume of the total civilian automotive gasoline you produce.

"This telegram supersedes and cancels Mr. Davies' telegram of July 7, 1942, except that you are still directed to produce the maximum quantities of the following materials: 100 and 91-octane number aviation gasoline and components thereof, toluene, butadiene, petroleum, synthetics and 87-octane number aviation gasoline which is now classified as a critical war product. Presently scheduled production of toluene concentrates and aviation and heavy duty lubricating oils should be maintained.

"All of the above instructions are to become effective as soon as practicable but in no case shall it take more than 10 days after receipt of this directive to accomplish the changes required.

"Within 10 days after receiving this telegram please furnish report showing bbls. per calendar day of crude natural gasoline, and other materials charged your refinery, together with bbls. per calendar day yield of 91 and 87 octane number aviation gasolines and the base stocks or other adaptable fractions, including but not limited to products which can be raised to these octane numbers by addition of maximum permissible quantities of tetraethyl lead, 80 on all purpose gasoline, civilian automotive gasolines, showing separately those having an octane number above 74, kerosine, 50 centane Diesel fuel, other Diesel fuel, distillate fuel oil, Navy special fuel oil and other residual fuels. This information should be reported for the month of August, 1943, and for your contemplated operations after making effective the terms of this directive. The Bureau of Budget number on this request for information is 42-4331.

"Reports and all correspondence in connection with this directive telegram shall be addressed to the director of re-

* * *

South Penn Cuts Deliveries To Refiners to 80%

Special to NPN

PITTSBURGH—The second cut in deliveries to its refiner customers by the largest buyer and seller of Pennsylvania grade crude oil became effective Oct. 1 when South Penn Oil Co. acted to bring its sales more in line with current production.

The cut brought South Penn's deliveries to 80% of deliveries in May. That month represented the peak in South Penn's sales. The company's first cut, effective June 1, was 15%.

As of June 1, South Penn was supplying crude to 13 refineries in Pennsylvania and West Virginia and one on the eastern seaboard.

Drastic Marketing Changes Seen on Coast

NPN News Bureau

LOS ANGELES—PAW's order restricting the output of civilian gasoline over 74 octane to 10% of the total amount of gasoline manufactured probably will force profound changes in marketing conditions on the West Coast.

In general it is believed that the independent marketer will be harder hit by the order than will be the larger units in the industry. During the last 2 or 3 months independents on the West Coast have embarked on a campaign of pushing Ethyl and soft-pedaling third grade. Many of them even discontinued third grade.

In some instances, independent refiners report that the campaign has boosted sales of Ethyl to 80 and 85% of total sales. The smaller refiners were also finding very profitable a new line of so-called Super-Ethyl's. However, under the PAW order, both of these Ethyl gasolines will have to be reduced to the 10% figure.

Opinion was expressed by one refiner that attempts to market 10% Ethyl would prove too much of a problem and that there was a distinct possibility that some marketers would discontinue the premium line altogether.

Another refiner said he was thinking of putting out only one grade of gasoline of around 74 octane. He thought this rating would probably be 2 points above the average rating of regular gasoline and would therefore retain some of the quality appeal of Ethyl.

Still another marketer thought something should be worked out with the Ethyl Corp. whereby 74 octane would be called Ethyl, 71 octane called regular, and 67 octane called third grade.

Of the major companies contacted only one had any plan worked out. Spokesman for this company stated it did not contemplate any change in marketing conditions. It would distribute Ethyl to stations in proportion to the total gallons sold and then let the service station operator do with it as he pleased.

On the other hand the independents had as many ideas as there are refiners.

Unofficially it is reported that in total 40% of the gasoline sales on the West Coast are now premium grade. Before the war it is estimated that only 10% of sales were Ethyl.

Official U. S. Navy Photo

. . . in the Aleutians

When our troops landed in the Aleutians, they wore special clothing to protect them from "the world's worst weather" — constant rain, cold, dampness and fog. And to protect their vital stocks of gasoline and oil from the damage this kind of weather could cause, their drums were sealed with *Tri-Sure Closures.*

All over the world, wherever the gas and oil for our planes and tanks need perfect protection, you will find Tri-Sure Closures on guard — with an *hermetic seal* that prevents even a drop of moisture from reaching the contents of a drum.

The dramatic story of the part these closures are playing in the war is told in "We Were There," a modern odyssey of history-making exploits in Africa, the Pacific, Tunis, the Aleutians, Java and Alaska. A beautifully bound, profusely illustrated copy of the De Luxe Edition will be sent free upon request.

Tri-Sure
Reg. U. S. Pat. Off.
CLOSURES

AMERICAN FLANGE & MANUFACTURING CO. INC., 30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.
TRI-SURE PRODUCTS LIMITED, ST. CATHARINES, ONTARIO, CANADA

fining for District 5 with a copy sent directly to the Director of Refining, Petroleum Administration for War, Washington, D. C.

"Kindly confirm your complete understanding of this directive by telegram or return mail."

You are also hereby authorized to grant in your own name or through Youker, upon a proper showing of facts, exceptions as to the operative provisions of the directive provided that they are for no longer than 30 days, that the refinery affected lacks facilities to enable compliance, and that arrangements will be forwarded during the 30-day period for exchange of stocks, sales, or processing agreements to carry out the purposes of this directive. Any extensions or renewals of such exceptions should be discussed with me before issuance. You and Youker are also authorized to extend to a total period of not more than 20 days the time in which reports required by the directive may be filed. Please keep this office advised by telegraph of exceptions or other actions taken hereunder.

E. D. Cumming,
Director of Refining

In disclosing move publicly, Ickes asserts move is "in line with PAW's policy of being ready at all times to meet military and naval requirements, whatever they may be."

Recognizing that motorists will complain as gasoline quality deteriorates, he expresses hope they will understand "that only by taking these measures can we meet increasing military requirements."

PAW Deputy Davies, pointing up need for adequate stocks military gasolines, said effect of operating changes won't be noticeable immediately to public.

Map Plan for West Texas Oil

PAW Seeks Definite Schedule from Each District 2 Refiner on Amount that Could be Run Under Varying Circumstances

NPN News Bureau

CHICAGO—C. H. Alberding, PAW District 2 director of refining, has asked all refiners in the area for a definite schedule of how much West Texas crude oil they can run, as the major problem facing the industry is lack of an adequate and specific crude supply. Mr. Alberding wrote the refiners on Sept. 28 that this is particularly so in District 2.

Idle refining capacity in District 2 is still reported at 205,000 b/d.

"Increased crude runs are desirable, and for the future warplant picture, necessary to this district," Mr. Alberding said. "In this connection, PAW, Washington, has requested us to determine a definite schedule of refineries where some, or an increased amount, of West Texas crude oil might be run, either with or without equipment changes.

Questions Listed

"It is recognized," he continued, "that there are many factors affecting determination of your company to run West Texas crude at its refineries. In order to obtain as definite a picture as possible, however, we would appreciate your answer to the following questions by Oct. 9, in order to meet the deadline set by Washington.

"How much West Texas crude would you run at your refineries if—

"1. Your present crude supply were unchanged but you were given authority to run as much West Texas crude above your presently authorized runs as desired.

"2. Your present crude supply failed and West Texas crude was the only crude available to you.

"3. You had your present supply of crude oil, and you could run additional West Texas crude which would be made available at Cushing, Okla., by the Stanolind Pipeline, at a transportation cost of not more than 22c per bbl., provided you were assured that tank cars would be available to transport the oil from that point to your refinery.

"4. Same as 3 with the additional assumption that the West Texas crude was the only crude available to you.

"5. On the assumption that the same amount of other crudes as at present would be available to you but that West Texas crude will be made available on the basis of compensation for additional cost of tank car transportation over a theoretical pipeline transportation or, pipeline plus barge, to your plant. For your information the theoretical pipeline rates that have been suggested would be approximately as follows:

Oklahoma	$0.22
Kansas Points	.25
Kansas City area	.40
Southern Illinois area	.48
Chicago area	.48

Other points in proportion.

"6. Same as 5 with the further assumption that the West Texas crude was only grade available to you."

Seek Data on Equipment

Other alternatives affect the processing of West Texas crude, Mr. Alberding said, and these should be indicated to give as complete a picture as possible. The refiners were asked how equipment changes or additional equipment would affect the amount of West Texas crude processed. An estimate of the percentage of West Texas crudes that might be blended with the refiners' other crudes is also wanted.

As an example of many West Texas crudes, Mr. Alberding quoted an analysis of crude from the Slaughter-Duggan field:

Gravity, A.P.I.	31.6
Sulphur, per cent	2.0
Salt before de-salting, lbs./1000 bbls.	300.0
After de-salting	28.0
400 end point gasoline, per cent	34.1
Octane number, motor method	54.7
Total sulfur, per cent	.32
Mercaptan sulfur, per cent	1.4
Hydrogen sulphide, per cent	.003
725 end point gas oil, total cut, per cent	33.7
Gravity, A.P.I.	31.6
Sulfur, per cent	1.6
Residual fuel, per cent	32.2
Gravity A.P.I.	12.4
Sulfur, per cent	3.7
Viscosity furol at 122 deg., approximately	400

Refineries Eligible for OCD Security Award

NPN News Bureau

WASHINGTON—Establishment of a "National Security Award" as a means of giving public recognition to outstanding achievements of certain essential facilities, including refineries, in protecting the safety of employees, plants and production schedules from air raids, fire, sabotage and accident has been announced by the Office of Civilian Defense.

Security Award Emblem

Awards will consist of a Certificate of Merit signed by the Director of OCD and a distinctive insigne bearing the words "National Security Award" which may be reproduced by the establishment receiving it on banners, letterheads, lapel buttons, award certificates for members of plant security organizations and in other forms.

Paralleling in some respects the awards by war agencies to industries for excellence in production, the award will be recognition by the Government of outstanding plant security programs without which, in many instances, production records could not be attained.

The award will be on nominations from the establishment itself, the local Defense Council, or from the federal agency assigned direct responsibility for that type of facility under the OCD Facility Security Program.

A board headed by Maj. Gen. U. S. Grant, 3rd, chief of OCD's protection branch, and consisting of representatives of management and labor organizations will review nominations and make the final decision on awards.

FACTS ABOUT

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1 Saturated gasoline vapors expand 20% or more during summer months and contain 10 to 25 gallons of gasoline per 1000 cubic feet.

2 At this rate, an 80,000 bbl. cone roof tank, one-half full, containing 250,000 cubic feet of vapor space, would expel per day 50,000 cubic feet of saturated vapor containing as much as *1000 gallons of gasoline.*

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The Graver Expansion Roof rises or falls as vapors expand or contract due to variations in temperature or volume. Being oil sealed all around, there is no expelling of vapors or breathing of moisture laden air. Absolute protection against vapor loss is assured. And, when spaced reasonably close together, several cone roof tanks can be manifolded to a single Graver Expansion Roof tank of suitable size, providing protection for the entire battery.

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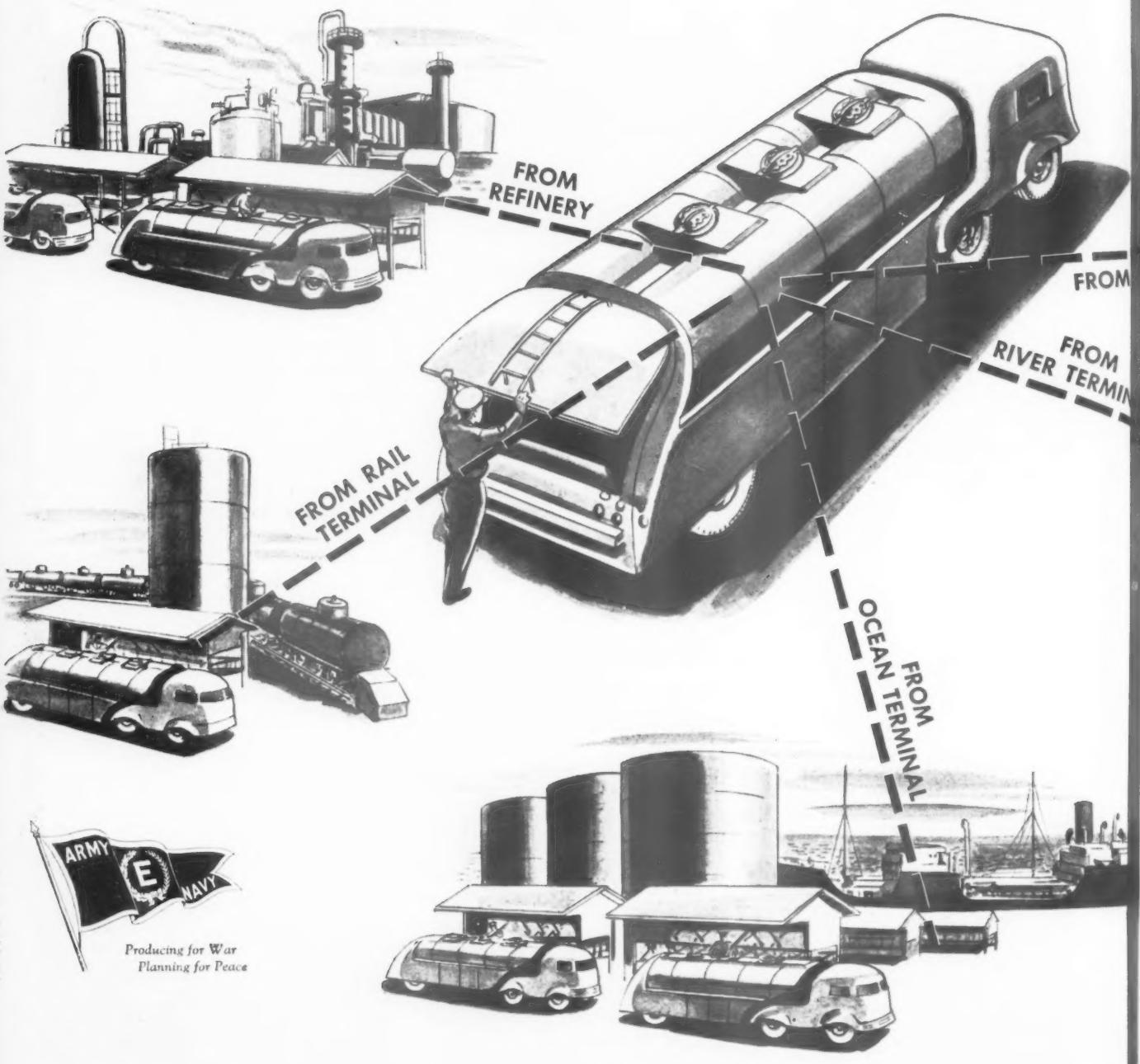
DISPERSAL HAULING...



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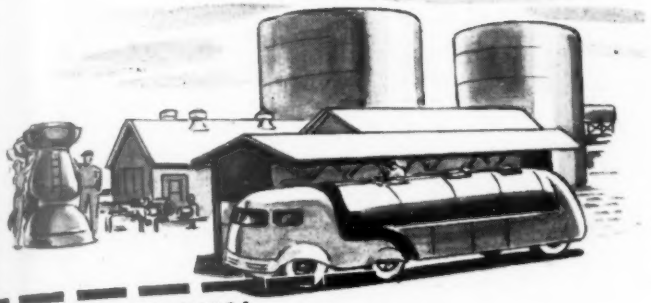
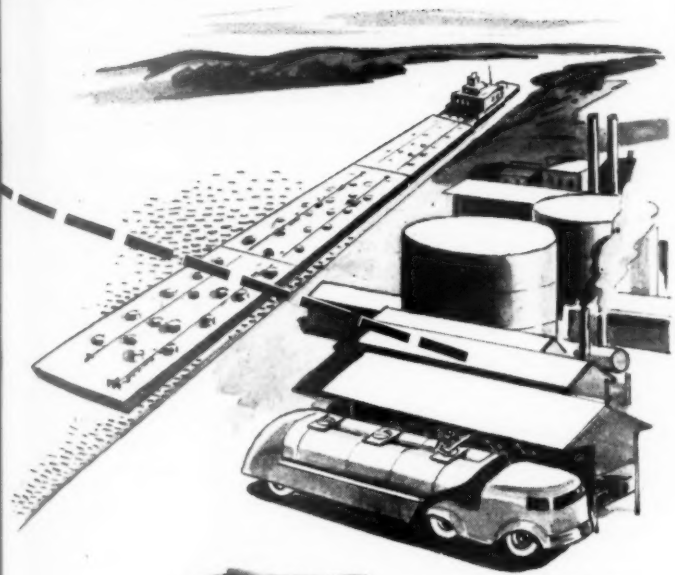
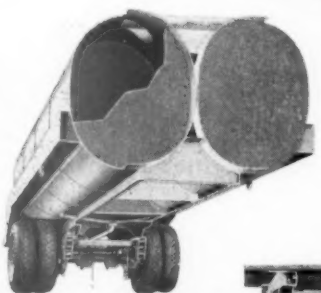
TERMINALS TO SELLERS

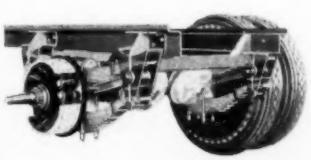


PIPE LINE TERMINAL





Butler Twin-Tank construction gives you the only transport with I-beam integral frame deeper than the tank body and a 20 to 1 factor of safety.



Two-Step Springing gives Butler Twin-Tank Safety Transport a soft, floating ride when traveling empty —frees it of road shocks, lengthens its life.

The products of oil are moving as they never moved before... by pipe lines, in barges, by tank car trains, in tankers, and by truck transports.

An evolution in oil transportation is taking place. Being determined now are such momentous questions as—To what extent will rail transportation be displaced? Can pipe lines compete with tankers? Are barge line facilities too expensive for inshore shipment? Will refineries move closer to markets?

No matter how the final outcome changes the pattern of distribution, one thing is certain—

THE TRUCK TRANSPORT IS UNRIVALED IN DISPERSAL HAULING

More oil products can be transported per pound of steel by truck transport; as a matter of fact, one pound or less of steel per barrel mile per day as against 2 lbs. for a 24-inch pipe line, over 3 lbs. for barge lines or 2½ lbs. for a 12-inch pipe line, according to competent authorities.

Well known is the record of single truck transports releasing from 10 to 20 tank cars for the long haul east. Now, records are being revealed showing how truck transports were largely responsible for increasing the average delivery nearly 3 times, cutting the number of bulk plants needed more than 25% and cutting the number of invoices per 1,000 gallons by two-thirds.

Many other cost cutting and distribution efficiency advantages stem from use of truck transports, whether they haul from ocean, pipe line, river, rail, or refinery terminals. From terminals these mobile pipe lines follow the highways direct to sellers.

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Threatens Penalty Tax On Natural Gas Piped Out of Texas

Special to NPN

AUSTIN—The Damocles sword of taxation is hanging over the heads of the sponsors of a proposed natural gas pipeline from Corpus Christi to West Virginia—strung up there by Gov. Coke Stevenson.

Gov. Stevenson has warned that the builders of the pipeline, the Tennessee Gas & Transmission Co., would be building it at their own risk, and intimated that a special session of the Texas legislature may be called to pass a severance tax on natural gas if the project goes through.

Construction of the 24-in., 1228-mile line, already approved by the WPB, has caused reverberations throughout the state on the argument that Texas' main attraction to industry, cheap fuel, will be drained off to the industrial east, leaving this state holding the bag. (U. S. Sen. W. Lee O'Daniel, when he was fighting the Big Inch pipeline, charged that it would be turned into a gas pipeline after the war, to the detriment of Texas' industrial interests.)

Gov. Stevenson said he was making a survey of the natural gas resources in the Corpus Christi area. The pipeline company has said it would carry off only gas that would otherwise be wasted, but the governor asserts the "waste" gas is being used to repressure the oil fields.

The new pipeline would have a capacity of 200,000,000 cu. ft. daily.

Gov. Stevenson also said he was considering the re-examination of gas conservation laws to see if they can be amended to specify the uses to which natural gas can be put.

Reminded that several companies had been exporting natural gas from the Panhandle for several years, the governor said they would have to suffer along with the others if the severance tax were put on.

FPC Postpones Indefinitely Hope's Pipeline Hearing

NPN News Bureau

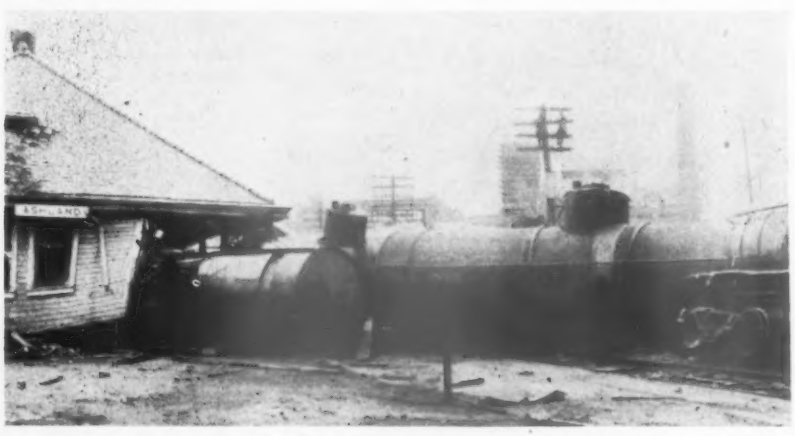
WASHINGTON — Federal Power Commission hearing on Hope Natural Gas Co.'s pipeline application (Hugoton Field to Cornwall Station, W. Va.) was indefinitely postponed at request of the company. Postponement follows FPC approval Sept. 25 of Tennessee Gas & Transmission Co.'s rival application, for natural gas line from Corpus Christi area to some point in West Virginia, conditional on submission of final plan of financing for FPC approval.

WPB Releases 1786 Vehicles For Week Ended Sept. 25

NPN News Bureau

WASHINGTON — WPB Automotive division announces release of 1,786 vehicles under truck rationing program during week ended Sept. 25. Total includes 407 light, 1,037 medium and 126 heavy trucks, 193 trailers, 24 third-axle attachments and a priority order for 1 miscellaneous vehicle not now in stock.

Total of 169,621 vehicles has been released since beginning of rationing (Mar. 9, 1942), including 39,092 light, 95,792 medium and 19,013 heavy trucks, 13,838 trailers, 1,790 third-axle attachments and 96 miscellaneous, report adds.



DERAILED TANK CARS START COSTLY BLAZE. A rubber factory and a freight house were damaged when 23 cars of an Erie tank car train were derailed at Ashland, O., and caught fire. Photo shows tank cars ablaze amid the wreckage of the freight house

Postwar Fate of New Tankers Among Worries of Oil Men

NPN News Bureau

NEW YORK—Two important problems in connection with stepped-up tanker operations are of growing concern to American oil companies: (1) payment of compensation, now totaling $26,000,000, owed by the government on excess war risk insurance, and (2) disposition of the nation's tanker fleet during the war and in the immediate postwar settlement period. These problems are causing increasing speculation among oil executives here as to government policy with regard to the ships and the whole future of tanker activity.

The marine departments of the major oil companies made their first contribution to the defense effort even before the declaration of war. Overnight and prior to Pearl Harbor the majors were called on by the government to turn over 25% of their tanker tonnage. Danger to shipping was especially great at that time. The submarine menace grew in East Coast and Gulf waters, and the oil companies protested even sending the tankers out of port.

In September, 1941, Interior Secretary Ickes asked the oil companies to move all petroleum products possible to the East. Each one of the majors requested signed a letter agreeing to do so, "relying," as one official says, "on the faith of the government to pay the bills after formal audit." These signatories to the government-industry agreement are given in the closing chapter of PAW Ickes' book "Fightin' Oil".

Freight Tax Not Compensable

The U-boat peril grew and the oil companies approached the War and Navy departments, as well as Ickes, OPA Chief Henderson and Defense Transportation Director Eastman on the problem. The firms were told to go ahead and move the petroleum products regardless of risk. They pointed out that under liability laws they could not sail until adequate insurance protection was guaranteed. The government still insisted, and approved the insurance, so as a patriotic duty the companies put their tankers to sea. War risks boosted insurance rates from one-quarter of one per cent to 10 per cent of ship valuation. In 60 days the oil companies had paid out $26,000,000 in excess insurance. Because of heavy losses the industry is now bringing in by tank car petroleum products, on which freight they are paying 3% which is not compensable under present DSC regulations.

Had this volume of crude and products been carried by tank ship, this 3% would have been eliminated, so cost to the companies is $3,000,000 a year more than it would have been under normal operation of hauling by water. This $3,000,000 tax on freight bills is not com-

(Continued on p. 39)

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Cooperation is the key to Victory—cooperation among the armed forces, industry, agriculture and all segments of the nation—and Chevrolet is proud to be a member of General Motors, which, from the beginning, has had such a full understanding of this fact. . . . Today, General Motors is building thousands of different items of war equipment. . . . The net result is that an ever-increasing volume of tanks, planes and aviation engines, guns, ammunition, vehicles and other products are pouring from General Motors plants, hour after hour, to speed the day of Victory. . . . General Motors has said, "Victory Is Our Business," and Chevrolet is proud to be playing its full part in this program, just as are all other G.M. units, subcontractors and suppliers.

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In addition to the General Motors Divisions whose trade-marks are reproduced above, all the following General Motors units also are contributing to America's war effort:

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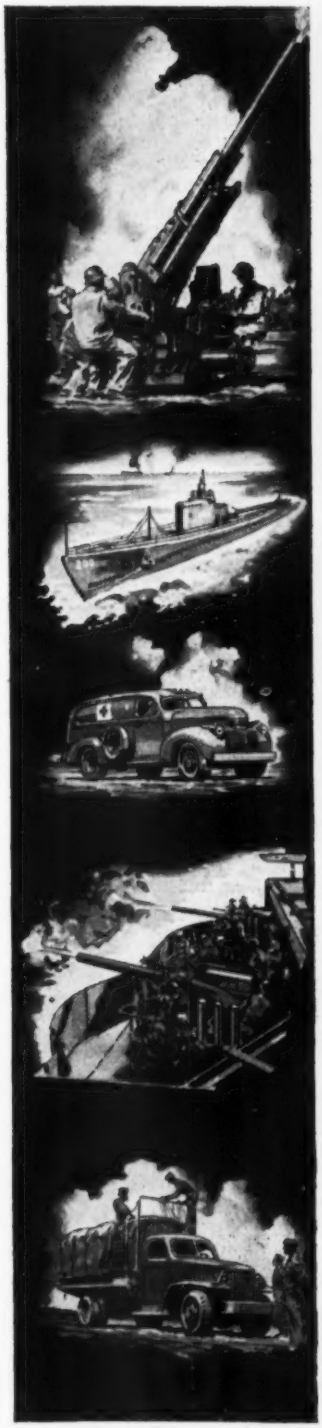

ORE BOAT BECOMES LAKE TANKER. On her "maiden" voyage Sept. 20 was a 47-year-old whaleback—the only one left on the Great Lakes—reconditioned, converted and renamed the SS Meteor. Formerly in the iron ore trade as the South Park, she was bought by Cleveland Tankers, Inc., subsidiary of Allied Oil Co., Inc., Cleveland, and converted into an oil carrier. She had been rebuilt twice before since her launching in 1896.

In order to convert the South Park, her double bottom was pierced between frames, her side tanks were limbered along the entire sides so that she carries her cargo directly to the shell, all seams were cut in way of transverse bulkheads and welded tight for water stops, and an expansion trunk was constructed on the main deck extending from the after end of No. 2 tank to the after end of No. 8 tank at the forward end of the after deckhouse. All told, 11 transverse bulkheads were installed, giving her 8 cargo tanks, after cofferdam, fuel tank and pumproom. These tanks were further subdivided by the installation of an oil-tight centerline bulkhead. Seventy-five per cent of the South Park's bottom was renewed, her boilers completely retubed, all breaching renewed, coke grates removed and oil burning equipment installed.

Equipped with six Wilson-Snyder steam driven duplex vertical cargo pumps, each capable of 1000 bbls. per hour at 100 lbs. back pressure, the new SS Meteor can load or discharge two different grades of cargo simultaneously. She carries 40,000 bbls. of gasoline on a draft of 18 ft. 6 in., and will probably do 12 miles an hour loaded or about 13½ miles an hour light.

Conversion was accomplished in 3 months, 27 days.

Addition of the SS Meteor, ex-South Park, brings to 5 the number of tankers being operated on the Great Lakes by Cleveland Tankers, Inc.

ODT Issues 'Guide' On War Necessity

NPN News Bureau

WASHINGTON—ODT Director Eastman on Oct. 1 announced the policy which will govern issuance of Certificates of War Necessity to operators of commercial motor vehicles intending to engage in new operations.

The occasion for the statement was his decision in the case of a mid-western beverage company which applied for a certificate and sufficient gasoline to operate between Milwaukee and Rock Island, Ill.

The beverage company, according to its application, ODT said, planned to divert present rail shipments to a truck recently purchased. The district ODT office denied the company's application, as did the regional office, where the case was taken on appeal. Mr. Eastman upheld this decision, finding that "the new operation would only add truck mileage without compensating public benefit."

Policy Is Outlined

In announcing his decision, Mr. Eastman made public a statement of policy to be used as a guide by ODT officials.

Henceforth, according to the new policy, no proposed new operations of commercial motor vehicles requiring Certificates of War Necessity shall be found to be "necessary to the war effort or to the maintenance of essential civilian economy" unless:

1. The service proposed cannot be performed at all by any existing means of transportation; or,
2. If existing service is not so convenient or expeditious as the proposed new service, and a positive need directly related to the war effort is shown for greater convenience or expedition; or,
3. If the service proposed will result in conservation of existing transportation facilities to a degree which outweighs in importance the added use of the new transportation facilities.

In addition, he said, if shortages of critical materials or manpower are involved, it will be necessary to show ability to furnish the proposed service without a measure of detriment caused by additional demands on such materials or manpower which would outweigh any public benefit.

Dome Loading Order Revoked

NPN News Bureau

WASHINGTON — Telegrams were sent out Oct. 1 by ODT advising oil companies that Special Direction ODT 7, Revised-2, issued July 24, which required dome loading of tank cars, has been revoked effective Oct. 3.

Tank Car Hauls Reach 792,356 b/d

WASHINGTON—Tank car hauls of crude and products to the East Coast totaled 792,356 b/d during week ended Sept. 25, compared with 739,120 the preceding week, PAW reports. Total of 25,709 tank cars loaded as follows:

Allied	45	Gulf	2058	Shotmeyer	1
Amsco	316	Hartol	178	Sinclair	1,122
Arkansas Fuel Oil	47	Hess, Inc.	40	Socony-Vacuum	3,794
Ashland Refining	82	Jenney Mnfg. Co.	74	Southland	13
Asiatic Petroleum	88	Libby	5	Southport	129
Atlantic Refining	1,426	Old Dutch	3	S.O. California	11
James B. Berry Sons	4	Pacific	49	S.O. Kentucky	95
Canfield	14	Pan American	1,228	S.O. New Jersey	5,804
Chalmette	28	Petroleum Corp.	5	S.O. Ohio	96
Cities Service	509	Petroleum Heat & Power	189	States	2
Continental	272	Premier	7	Sterling	7
Crown Central	57	Primrose	36	Sun	2,236
Crown Petroleum	5	Pure	117	Talco	34
Daugherty	10	Republic	78	Texaco	2,418
Drake	2	Richfield	216	Tide Water	1,200
Elk Refining	48	Royal Petroleum	170	Tiona Petroleum	2
Freedom Oil	3	Shell	1,217	Triangle	25
Globe	92				

★ WAR RUNS A TOUGH LABORATORY . . .

— but in it today is being developed the advance-design, precision-built Balcrank lubrication equipment of tomorrow. Much that yesterday we considered "advanced" is today obsolete.

Postwar "Service" business will present new problems. New problems will demand new products, new equipment, new merchandising.

While busily satisfying the insatiable demands of Mars today, Balcrank engineers are working on lubrication ideas — (some definitely revolutionary) — against the day when fulfillment will suddenly be necessary.

You, too, are looking ahead. Perhaps some of our ideas will help you give sharper outline to the picture you envision for tomorrow.

Simple, Strong and Efficient! Standard equipment on many army trucks, trailers, jeeps, and scout cars, because "they pack a lubrication wallop!"

ARMY E NAVY

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CINCINNATI 9, OHIO

PLANTATION PIPELINE: ITS OPERATION A

By James Collins
NPN Staff Writer

GREENSBORO, N. C.—Just six miles from this southern town is one of the most modernly-designed oil terminal facilities in the country, supplied round-the-clock by the Plantation Pipeline system which is still the largest ever built for the handling of refined products and one of the largest all-electric-powered pipelines in existence.

At New Jersey Standard's terminal can be seen abundant evidence that the tank truck has become a powerful component of fast, efficient petroleum distribution in the Southeast. An average of 200 transports, of about 4000 gal. each, pull away from the terminal's loading racks every day for points up to 150 miles distant throughout North and South Carolina.

Just a few of the big transports that are loaded daily at New Jersey Standard's terminal at Greensboro, N. C., which is supplied by the Plantation pipeline

One Every 6 Minutes

During March of this year, one truck was loaded every 6 minutes and a tank car every 10 minutes—a total of 5916 trucks and 3569 tank cars. Products moved out in that month totaled 49,910,498 gal.—an accomplishment R. H. W. Jones, superintendent of the terminal, is mighty proud of. He's disappointed, though, that the total didn't reach an even 50 million gallons. "That would really have been a mark to shoot at."

Situated about a quarter of a mile away from the Plantation Pipeline delivery station, the Jersey Standard storage tanks were the first things that came under this reporter's eye. Camouflaged with drab olive and apple green paint, they take on the appearance, at first glance, of rolling hills.

There are 7 storage tanks for gasoline and 4 for kerosine, totaling 560,000 bbls. capacity. A smaller tank of about 5000 bbls. is used to store fuel oil but this is supplied by tank car; very little fuel oil has moved through the pipeline during the past year.

How 'Slop Tank' Works

There is still another tank—perhaps the most interesting from the standpoint of the way it is used in the terminal operations. Called a "slop tank," it is situated a few hundred feet from the manifold pipes which channel the products, as they enter the terminal through the pipeline, into either gasoline or kerosine tanks.

The tank is used to accommodate the most contaminated part of a "batch change" which occurs when the pipeline starts feeding a different product into the terminal.

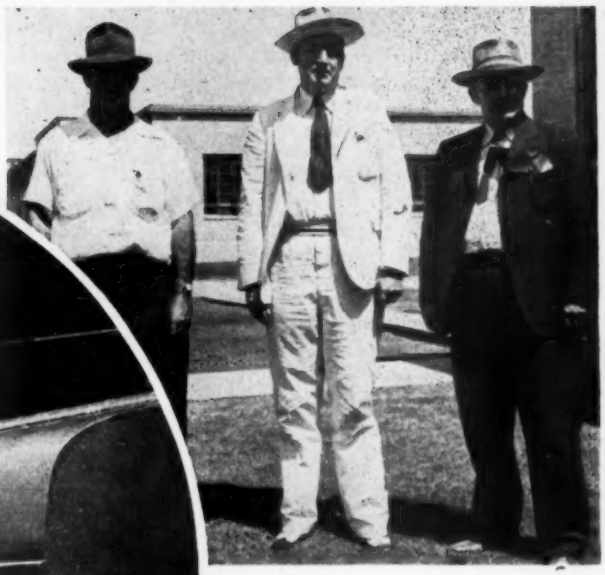
First indication that a batch change was to occur came when the delivery station, a quarter of a mile away, called the terminal superintendent to notify him that another product, say kerosine, was coming through the line and should arrive in about half an hour. (With this, you start to get an idea that the pipeline and terminal are run something like a railroad—and you're not far wrong.)

Watch Those Smokes!

The superintendent was taking a few last puffs on a cigaret. He tamped it

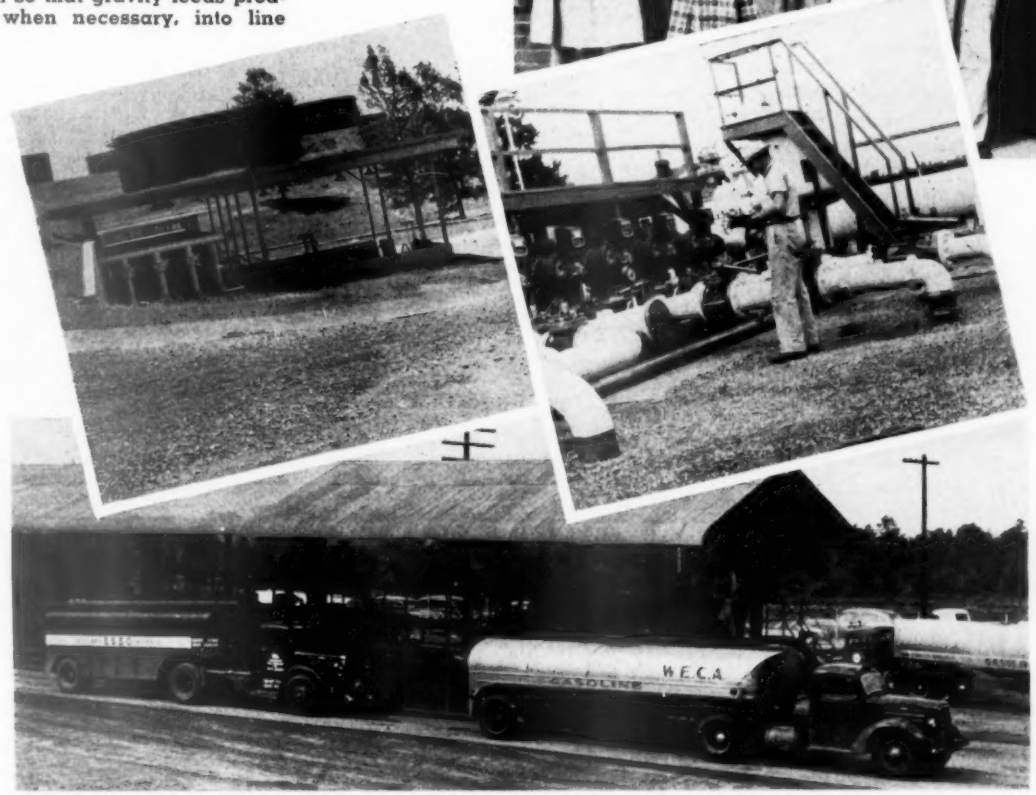
Above, a close-up of a big transport being loaded at the Greensboro terminal. Right, map shows course of Plantation pipeline from Baton Rouge to Richmond, Va. Broken line represents the Bayou system which ties in with Plantation at Baton Rouge

A MODEL OF EFFICIENCY



Above, three of the men who help maintain Plantation pipeline as one of the country's most efficient oil carriers. Left to right: L. C. Jordan, terminal chief at Bremen, Ga.; Charles A. Younts, Plantation's president; and H. V. Britton, company's chief engineer who designed the line. Left, a mechanic checks tires on a transport

Below, view of Plantation's pumping station at Bremen, Ga., showing storage tanks ideally located on hill so that gravity feeds products, when necessary, into line



Above are the men and women who make up the office staff of New Jersey Standard's terminal at Greensboro, N. C. At right is R. H. W. Jones, terminal superintendent. Left, a worker checks pressure gages and meters at Plantation's delivery terminal. One of pipes in foreground delivers products to Jersey's terminal; another delivers to Shell Oil Co.'s terminal; and a third connects with a station which pumps northward to Richmond, Va. Below left is a War Emergency Cooperative Assn. truck loading at the terminal

out before stepping outside the office building. (Anyone found smoking on the open grounds of the terminal would probably be drawn and quartered.) Then the party, made up of Mr. Jones, his assistant, a helper, and this reporter, strolled down across the open terminal area to where the "header" pipe pops out of the ground and into the pipe manifold.

The pipe rises vertically from the ground for a distance of about 3 or 4 feet and then runs horizontally for 20 or 25 feet. Lead-off pipes spaced along this horizontal section feed into the storage tanks.

We Look Inside

Near the header pipe is a small eye-piece of thick glass which permits a look-see into the line. A quick glance showed a rusty-brown liquid streaming through. Mr. Jones said it was premium gasoline but that the liquid would soon get lighter in color. When it finally changes to a water-white color, he explained, the product will be kerosine.

Suddenly, the telephone, situated in a small, make-shift "laboratory" a few feet away, started to ring. It was the pipeline delivery station again with word that the first drop in gravity had been noted in the product in the pipeline. The same drop was recorded at the terminal by Mr. Jones' assistant about 3 minutes later, from a sample taken from the header pipe and drained into a foot-tall glass beaker.

Take Sample Every Minute

Samples were drained off each minute during the batch change and tested with a special type hydrometer. The specific gravity went down degree by degree until it was midway between premium gasoline and kerosine.

Another glance through the eye-piece showed the liquid becoming more cloudy each minute. This, it was explained, was the heart of the contaminated slug between the gasoline and the kerosine. During all of this time, the product was still flowing into a gasoline storage tank a few hundred feet away. Then a valve was thrown on the manifold to divert the worst of the mixed gasoline-kerosine into the "slop" tank.

Why not switch directly to the kerosine tank?

Keep 'Gas' Out of Kerosine

"Well," Mr. Jones explained, "it doesn't make any real difference if we get some kerosine in the gasoline tank, because it will lose its identity there, but just a few barrels of gasoline in the kerosine tank would make for a highly dangerous mixture and spoil all of the contents already in the kerosine tank."

Another glance through the eye-piece a few moments later revealed the product almost colorless. A tested sample turned out to be all kerosine and a few moments later the slop tank valve on the manifold was closed and the flow diverted into a kerosine tank. For the next 24 hours or so, 38,000 bbls. of kerosine streamed through the manifold and into storage.

The mixture of gasoline and kerosine, channeled to the "slop" tank, is later transferred to all of the gasoline tanks, each getting an equal share.

Specifications Checked

A close check is made periodically of the contents in each storage tank by H. B. Carlisle, terminal chief, to make sure that each product comes up to its required specifications.

He works at this part of his duties in a sunshine-bright laboratory located at one end of the main office building. Tested samples of each product are kept on file at the terminal for examination and some are sent upon request to Standard's research department at Bayonne, N. J.

After the lesson on batch changes, we toured the storage tanks. We climbed long, winding stairways to the top of gasoline and kerosine tanks and, instead of inspecting the surrounding countryside from a vantage point 100 feet up in the air, as this reporter had contemplated, we found ourselves listening with interest to a discussion by Mr. Jones on floating pontoon roofs.

Trucks Follow Routine

During the several hours it took to go over batch change operations, and storage tanks, detail by detail, large tank transports had been roaring up the highway a few hundred yards away, entering the gate and loading at the racks.

Turning into the gateway, each truck is stopped by the gate guard where the driver registers himself and his truck. After this formality, the driver is given a "billing ticket" which is checked by the gate billing clerk who makes sure the truck is authorized to load at the terminal load racks. If so, the driver is issued a "loading ticket" which he takes with him to the racks.

If the loading racks are not full—they accommodate 8 trucks at a time—the driver pulls into a vacant position and hands over his loading ticket to a loader who checks it. (One interesting sidelight to this routine is that if the racks happen to be full, "the line forms on the right," and Mr. Jones sees to it that no truck, whether "Esso"-owned or otherwise, humps to the head of the line.)

If the loader finds the ticket in order, he spots the truck at the proper meter for the product to be loaded. He examines the tank to be sure it is empty so that no contamination will occur. After this is done, the bottom valves are closed and sealed and loading gets under way.

The driver of the truck takes care of this operation under the loader's supervision. He inserts his loading ticket, which is in duplicate, in the loading meter after it has been returned to the zero mark.

At the rate of about 300 gal. per minute, the tank is filled in from 12 to 15 minutes. When loading is complete, the ticket is removed from the meter which has stamped on it the number of gallons put into the truck's tank. The loader records this information on his record sheets and after the dome covers have been sealed, the driver pulls away to make room for the next transport.

The driver still has to check with both the gate billing clerk and the gate guard who send him on his way if everything is found in order. In a matter of minutes the transport disappears up the highway and one more truckload of petroleum is on the last lap of a long trip from the Southwestern oil fields.

Tank Car Use Drops

The tank car loading racks can handle 24 cars simultaneously with about 30 minutes required to load them. A maximum of 7 "switches", or 168 tank cars in all, can be handled daily. However, tank car shipments out of the terminal have fallen off considerably with the increased tempo of tank truck operations.

Fuel oils and lube oils move into the terminal in large quantities. Located at the end of the rail siding are 7 lube and industrial oil storage tanks with a capacity of 16,000 gal. each.

The tank truck racks are so equipped with 34 three-inch filler lines that a truck can load kerosine, fuel oil, regular gasoline, or premium gasoline at any of the 8 positions.

Has 7 Feeder Lines

Seven feeder lines extend from the storage tanks to the truck loading racks. "Esso" regular gasoline flows through one 8 in. and two 6 in. feeder lines; "Esso Extra" gasoline through a 6 in. line; kerosine through two lines, one of 8 in. and the other of 6 in.; and fuel oil is fed through one 6 in. line.

Designed with this flexibility, loading at the tank truck racks resembles a chain belt operation as loaded trucks pull away and empty ones slip into the vacated positions.

About 65 workers make the terminal tick. Four are mechanics who keep the terminal's 22 pieces of rolling stock in shape; 8 are truck loaders, one for each loading position on the racks; 5 are gate billing clerks who keep the records straight; 5 are watchmen; 3 are terminal foremen; and the remainder are clerks and helpers.

Jones is Top Man

Top man is Mr. Jones who acts as roving quarterback and keeps the whole mechanism of the installation operating smoothly. He is loud in his praise of his office staff which keeps all the detailed paper work in order, of which there is plenty.

Life-line for this delivery terminal is the Plantation Pipeline which took a Presidential proclamation to build.

Although the idea for the Plantation system had been in a few men's minds for several years, ground could not be broken until right-of-way had been ac-

quired along the length of the route. Stumbling block was the refusal on the part of a couple of southern states to permit the line to pass through their territories.

Passage of the Cole Pipeline Bill, however, cleared the way, and on Aug. 23, 1941, the President signed the proclamation which designated the proposed pipe line as an "emergency project". Just four weeks later—on Sept. 19—contracts were let on the pumping stations.

Is 1452 Miles Long

The line was first built along a 1254-mile stretch between Baton Rouge, La., and Greensboro, N. C. Later it was extended another 198 miles into Richmond, Va. It passes through Mississippi, Alabama, Georgia, South Carolina, North Carolina, and Virginia, with laterals reaching out in Tennessee, southern Georgia, and Alabama. Initial capacity was 60,000 b/d but with addition of 14 pumping stations this was stepped up to 90,000 b/d.

Costing about $25,000,000 all-told, the line added to future Axis grief a gasoline and light product distributing system which could supply half of the gasoline requirements for these 6 southern states, an area which supports over 15% of the country's population.

A common carrier, operating under ICC jurisdiction, the line immediately started serving an area of 2,200,000 buses, trucks, passenger cars and tractors formerly dependent upon petroleum products delivered by water.

Rushed Construction

A total of 3500 men, 450 trucks, 400 tractors and 300 welding machines were on the job at the peak of construction work.

On Jan. 1, 1942, the first oil was pumped into Baton Rouge, La., and the first delivery made at Meridian, Miss., on Jan, 22. The Greensboro terminal received its first slug on Feb. 12.

Fabrication of pipe was especially studied so that it would approach, as nearly as possible, one straight tube and thus eliminate "pockets" of contamination within station piping.

Fed by the Bayou System out of Texas to the tune of 57,000 b/d, the line also receives products by tanker and Mississippi barges. Between Baton Rouge and Bremen, Ga., the pipe is 12 in., and between Bremen and Greensboro, 10 in. The lateral from Bremen to Knoxville, Tenn., is 8 in. and the extension from Greensboro to Richmond —the Defense Supplies Corp. leg of the line, which was completed in January of this year— is 8 in. pipe.

Original Equipment

As originally equipped, the line to Greensboro had 14 main-line pumping stations with a capacity of 60,000 b/d of gasoline through the 12-in. section, and 42,000 b/d through the 10-in. section. This required two 600-HP motor-driven main line pumps for each of the 7 stations on the 12-in. line, and two

FROM A STATEMENT BY JOSEPH B. EASTMAN, DIRECTOR, OFFICE OF DEFENSE TRANSPORTATION

"... the preservation, conservation and maintenance in effective condition of motor transportation is just as vital to the nation as is the preservation, conservation and maintenance in effective condition of ... any other form of transportation."

★ ★ ★

General Motors Truck dealers were pioneers in truck conservation. Their Preventive Maintenance procedure, originated way back in 1928, has served as a pattern for both ODT and Army maintenance programs. Their entire service facilities ... men, equipment and methods ... have been geared to wartime needs of truck owners. Your trucks will roll longer and more efficiently if you give them regular GMC Service.

Special "Service Payment Plan" available through our own YMAC

★ BACK THE ATTACK

Pledged U.S. TRUCK CONSERVATION CORPS

GMC VICTORY MAINTENANCE KEEPS YOUR TRUCK ON THE JOB

★ BUY MORE BONDS

THE TRUCK OF VALUE

GMC TRUCKS

GASOLINE • DIESEL

450-HP units in each of the 7 units on the 10-in. section. Each of 3 laterals was served by a single 150-HP unit and at the origin of the fourth branch line, a 450-HP unit was required, plus an additional booster station which required a single 450-HP unit.

When designs first went on paper for the system, the 14 mainline pumping stations were so spaced and so equipped with specially-designed electric motor-driven pumping units that they could be changed over to higher capacity by substitution of new impellers in the pumps and a slight change in the fan equipment of the motors. When the line's capacity was increased to 90,000 b/d, these changes were made along with installation of 14 new pump stations spaced evenly along the line between the original stations.

Automatically Controlled

All of the stations operating in a continuous section of the line are affected by any change in flow that may occur. There are many changes in flow rate throughout the entire system because of the large number of delivery points, or terminals, which can be used for multiple deliveries or for single full-line capacity deliveries.

The station pressure controls are designed to adjust immediately each station to these varying flow conditions and so maintain uninterrupted operation. The control system along the entire line is fully automatic and an ingenious teletype communication system hooks into each pump station and into the dispatcher's office in downtown Atlanta, Ga.

Designed to meet the practical requirements of products-line operation, the Plantation Pipeline has not only served these needs more than adequately but has proved a life-saver to the oil-famined East.

Best example of this was the alleviation of Washington's acute gasoline shortage last spring. Over 4,000,000 gal. of gasoline were trucked from the Greensboro terminal into the nation's capital—gasoline which kept essential transportation rolling.

Rates Oil As 'Key Element' In International Sphere

NPN News Bureau

NEW YORK—Petroleum has become a key element in the international sphere because of the needs of modern transportation, Dr. Joseph E. Pogue, petroleum economist and vice-president of the Chase National Bank, told a radio audience Sept. 28 over Station WHN, New York City.

Stressing the international role that oil will play in the post war world, Dr. Pogue asserted: "Its development must go hand in hand in the reconstruction and maintenance of a rising standard of living."

"The problem of postwar world reconstruction cannot proceed along sound economic lines without the establishment of petroleum in a role consistent with its importance," the economist continued. "For this purpose it is necessary that the U. S. formulate a foreign oil policy that will at the same time serve the interests of our country and further the productivity and volume of trade of foreign countries. Such a policy should be friendly to American enterprise, which has demonstrated its ability in oil developments the world over, and should have the objective of making foreign oil activities commercially attractive, so as to create a dynamic urge toward further progress."

National Petroleum News Ownership Statement

Statement of the ownership, management, circulation, etc., required by the Act of Congress of August 24, 1912, and March 3, 1933, of National Petroleum News, published weekly at Cleveland, Ohio, for October 1, 1943. State of Ohio, County of Cuyahoga.

Before me, a notary public in and for the State and County aforesaid, personally appeared A. E. Kraft, who, having been duly sworn according to law, deposes and says that she is the business manager of the National Petroleum News and that the following is, to the best of her knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to-wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, The National Petroleum Publishing Company, Cleveland, Ohio; editor, Warren C. Platt, Cleveland, Ohio; managing editor, V. B. Guthrie, Cleveland, Ohio; and business managers are: A. E. Kraft, Cleveland, Ohio.

2. That the owners are: The National Petroleum Publishing Co., Cleveland, Ohio; Warren C. Platt, Cleveland, Ohio; Bess H. Platt, Cleveland, Ohio; A. E. Kraft, Cleveland, Ohio.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of the total amount of bonds, mortgages, other securities are None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holders appear upon the books of the company as trustees or in any other fiduciary relation, the names of the person or corporation for whom each trustee is acting, is given; also that the said two paragraphs contain statements embracing affiants' full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds or other securities than as so stated by her.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise to paid subscribers during the six months preceding the date shown above is (This information is required from daily publications only).

(Signed) A. E. KRAFT, Business Manager

Sworn to and subscribed before me this 1st day of October, 1943.

(Signed) F. S. FRASER, Notary Public

(My commission expires March 10, 1944.)

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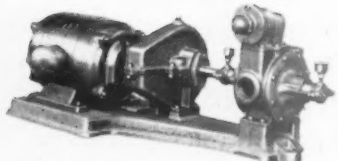

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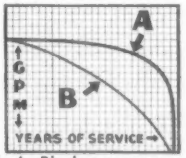
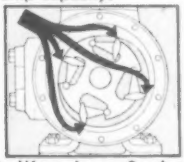
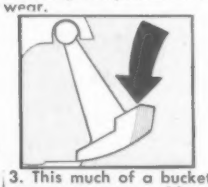
The drawings show you why—



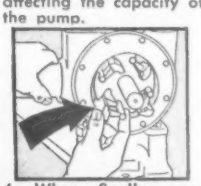
1. A—Blackmer pump capacity. Note the long sustained efficiency. B — Conventional rotary pump capacity.



2. Wear is confined to these points; the tips of the buckets, which automatically compensate for wear.



3. This much of a bucket can wear away, without affecting the capacity of the pump.



4. When finally worn out, the buckets are easily replaced (a 20-minute job) and the pump restored to its original efficiency.

PAW Ruling Permits Closer Spacing In Michigan Area

NPN News Bureau

WASHINGTON—As a result of an order issued Oct. 2 by PAW, greater development of oil fields in 12 southwestern Michigan counties will be possible.

In an amendment to a formal order (Supplementary Order No. 7, amended, to PAO No. 11), closer oil-well spacing patterns are permitted with a view to increasing the number of producing wells in that section. PAW Ickes said the action was taken to provide additional production capacity close to the important refining, industrial, and consuming centers of the Mid-West.

He also pointed out that under the closer spacing provisions of the amended order, operators will find it easier to develop their oil properties since the producing formations in southern Michigan are in most instances irregular.

Davies Outlines Order

Highlights of the order, as outlined by Deputy PAW Davies, are:

The supplementary order continues to affect producers in Allegan, Barry, Berrien, Branch, Calhoun, Cass, Kalamazoo, Kent, Muskegon, Ottawa, St. Joseph, and Van Buren Counties, Michigan.

An oil well may be drilled on a 10-acre tract, provided the well does not exceed 1400 ft. in depth. Previously, the order established a 20-acre spacing pattern for wells of 2000 ft. or less.

If an oil well is drilled to a depth of 1400 to 2500 ft., a 20-acre spacing pattern will prevail.

The 40-acre spacing pattern (as defined by PAO No. 11) will apply to all wells drilled to depths greater than 2500 ft. This provision will not affect present operations, however, since no field in the affected counties produces at those depths, Mr. Davies said.

Now, a well may be drilled at a point 300 ft. from the nearest unconsolidated properties. Previously, a 330-ft. limit was required.

Imports Vital Unless New Oil Is Found, Engineers Told

Special to NPN

TORONTO—Imported oil supplies are in the picture for the U. S. unless new oil fields are found, E. G. Bailey, vice-president of Babcock & Wilcox Co., New York, told a joint meeting of the American Society of Mechanical Engineers and the Engineering Institute of Canada, meeting here Sept. 30-Oct. 2. He also warned that there is a strong possibility that more coal of lower grade must be used for power generation.

Mr. Bailey said: "The petroleum industry is now requesting a substantial increase in the price of crude in order to stimulate discovery of new oil fields. Unless substantial discoveries are made, we may shortly be forced to import oil from abroad, and probably also make it from coal and oil shale. Any source of additional oil supply will probably result in a sufficient increase in the price of petroleum products to cause a long time readjustment of the relative economies of oil and coal for many uses in some parts of the country. If the price of fuel and the price of equipment are to change materially, the future designs will still have to be made on a basis of estimates and judgment. It seems safe to say that we will probably burn a larger proportion of coal, and that of a lower quality than we have used in the past."

For years, Mr. Bailey told his listeners, many companies have developed power and heating equipment which required the use of high grade fuel without giving consideration to the long range welfare of their customers and the nation, regarding the reliability of the supply and the probable price of the necessary fuel. The petroleum industry balanced its production in the most advantageous way so long as it could find a market for residual oil at a price competitive with coal.

Denver Hearing Is Set Nov. 17 To Discuss Unit Development

NPN News Bureau

WASHINGTON — A public hearing will be held in the Cosmopolitan Hotel, Denver, beginning at 10 a. m., Wednesday, Nov. 17, on proposed Interior Department regulations to govern development and operation as a unit of oil and gas deposits on public lands, Interior Secretary Harold L. Ickes announced Oct. 1.

The hearing is open to oil and gas lessees, operators, members of the petroleum industry generally, and others who may be interested in or affected by the regulations, Mr. Ickes said. It is expected to be in session three days.

Those in attendance may present additional written or oral comments, criticisms, and suggestions with respect to the regulations, in accordance with a published invitation by the department in the Federal Register of last April 10.

The interest evoked by the official notice of April 10, Mr. Ickes said, has been widespread.

Assistant Secretary of the Interior Oscar L. Chapman will preside at the hearings, assisted by William E. Wrather, director of the Geological Survey.

282,000 Bbl. Drop Reported In Sept. 25 Crude Stocks

NPN News Bureau

WASHINGTON—U. S. stocks of domestic and foreign crude totaled 233,013,000 bbls. on Sept. 25, compared with 233,295,000 bbls. the previous week, a drop of 282,000 bbls., Bureau of Mines reported Oct. 1. Stocks of foreign crude decreased by 330,000 bbls., while domestic stocks increased 48,000 bbls.

Largest area decreases were in Oklahoma, down 350,000 bbls., Rocky Mountain region, down 164,000 bbls.

Drillers' Exemptions Up to Boards

Special to NPN

AUSTIN—Deferment of oil well drillers is a matter to be decided by individual local boards, Beauford Jester, chairman of the Texas Railroad Commission, has been advised by the National Selective Service office.

Citing the difficulties encountered by oil well drillers, Mr. Jester wired and asked for an opinion on what deferment status oil rig workers could expect.

Lt. Col. Geoffrey J. O'Flynn of the selective service manpower division replied:

"In the local board is vested the discretion to determine the selective service status of any registrant, subject to appeal.

"Therefore, in the oil industry, employers should file written requests for occupational deferment with evidence of irreplaceability, for consideration of the local board. If such men are classified in 1-A, the case may be appealed to the board of appeal. If the decision of the local board is affirmed, the state director may be requested to review the matter to determine if an appeal to the President is warranted."

Henderson Strike Rated New; Gets Discovery Bonus

Special to NPN

AUSTIN, Tex.—The Texas Railroad Commission has designated the Beacon Oil & Refining Co. strike 3 miles northwest of Henderson, Texas, as a new field and given it the name of Henderson Field.

The discovery well (J. H. Allen No. 1) is only 3 miles from the famous well of Dad Joiner that opened the East Texas field, but is nearly twice as deep.

Well and its offsets will be eligible for the recently-announced bonus for new fields.

At the same time, the commission made it apparent that new wells brought in in the Panhandle area will not receive the discovery bonus. Commissioners Beauford Jester and Olin Culberson voted down Ernest O. Thompson and refused the new field allowable for the Magnolia's No. 1 Dorsey well.

DEMANDS MANPOWER RELIEF

(*Continued from p. 8*)

state rules of the past, Mr. Wilson said.

Warren C. Platt, editor of NATIONAL PETROLEUM NEWS. also talked on "The Future of The Independent". He pointed out how the appointments of independents to positions of importance in PAW and other government agencies and the creation of new jobber committees showed greater recognition of the independents.

President Jankowiak appointed the following as a resolution committee: Elmer Ledbetter, Wayne Oil Company, Detroit, chairman; C. J. Crooker, Ontonagon; William Olsen, Frankford; I. B. Dworman, Detroit; Kenneth Patterson, Bay City; Dan Haley, Saginaw.

Vandeveer Asks Cooperation

The second day was the "grass roots" conference with PAW District 2 Director Vandeveer and his associates. These associates were Ernest L. Hughes, marketing director, H. W. Nankervis, Wisconsin Independent Oil Jobber and Philip P. Denton.

Mr. Vandeveer said in part:

"We are here to get your ideas so that the Petroleum Administration can plan with your help the best solution to the fluid petroleum problems . . . just as they develop right here on the firing line. . . .

"Many problems which confront the Marketing branch of the petroleum industry can be solved locally . . . without the need for calling on the government for help. Too many people feel the best solution to a problem is government help. This means a government directive which would affect operations in *your town* just as it would affect all other towns in the nation. Would it not be better . . . infinitely better . . . to work out the solution to these problems right here in your own back-yard . . . by yourselves. . . .

"The value of competition to the oil industry and to the country at this time . . . and more particularly after the war, has been proved through the years. *This war* is being fought to preserve and protect such rights among nations, and it hardly stands to reason that we should fight to win this war for individual enterprise abroad and thoughtlessly toss it away in our own country. . . .

"We, in the Petroleum Administration, will do everything we can to maintain this right of competition, so that it will be here after the war."

Mr. Hughes likened PAW's job to that of an umpire whose success depended not so much upon his own decisions as upon the sportsmanship of those in the game.

He asked the advice of the members on PAW employing 5 or 6 marketing men to travel among the marketers and help them in their teamwork and cooperation with each other and PAW. These men would aid in interpreting PAW's rules, regulations, what its desires were and would bring in to PAW reports as to what the jobbers and marketers thought should be done. If the jobbers didn't think well of the idea, he said it would be dropped. These men would be hired within the present budget of PAW. On a showing of hands a majority voted in favor.

Naphtha Problem Discussed

In the question and discussion period complaint was made that stove and lamp gasoline (naphtha) are being liberally sold to the motorists and used for motor fuel without coupons.

Mr. Hughes said his office recognized the seriousness of the problem, but the trouble was the finding of a yard stick by which to measure the consumers' needs of naphtha.

As to the 72-hour limitation on service station hours, Director Hughes said that an order was about to be issued which would leave the opening of service stations to the determination of the oil industry in each area to be selected by the industry.

Dan Haley of the Quality Seal Oil Co., Saginaw, said that the order wouldn't work and he didn't believe that PAW had any business fussing with the oil marketers' labor problem.

To this Director Hughes replied that he entirely agreed. But, he said, PAW cannot refuse an effort to help the industry when the industry appeals to it.

I. B. Dworman of Detroit feared if the dealers were permitted to fix the hours, they would consider their own comfort and not make the hours comprehensive enough. He preferred the present directive.

Paul Kempf of Ann Arbor asked Mr. Hughes what was being done to insure the jobber a fair share of the available petroleum products. Director Hughes said that PAW was insisting that everyone share alike, refiners, marketers and dealers. And that company owned stations not be favored. The best way to give the jobber fair treatment he said, is to get more oil, and PAW is now seeking more oil from West Texas on a compensatory freight train arrangement with the Defense Supplies Corp.

Royal E. Decker of Detroit asked the privilege of the floor for a few comments to Director Vandeveer and his associates. Decker said that the jobber does not want less than 3 gallons per coupon in District 2. He said that OPA is now proposing a roll back of coupons to the refiners, the reason given he said being "to save OPA work". He asked, "Why not let OPA do some work?" He urged PAW to see that unnecessary reserves were not built up in the East in the effort to get sufficient supplies down there.

Text of Michigan Assn. Resolutions

Following is the text of resolutions adopted by the Michigan Petroleum Assn. at its Sept. 29-30 meeting in Traverse City:

I. WHEREAS, The sale of so-called stove and lamp fuel and/or naphtha are important items in the petroleum industry and any violations of restrictions as to their sale are detrimental to the war effort and the industry itself;
WHEREAS, It is well known that certain rationed products are being sold as unrationed commodities without coupons;
BE IT RESOLVED THEREFORE, That this matter be brought to the attention of the Office of Price Administration, and Federal Bureau of Investigation for a thorough and adequate remedy.

* * *

II. WHEREAS, The supply and distribution of petroleum including anti-knock ingredients is being greatly curtailed through the needs of the armed forces and it is expected that this curtailment will continue to increase, and
WHEREAS, An equitable distribution of these products is the only means whereby the interests of the entire industry can be safeguarded;
NOW THEREFORE BE IT RESOLVED, That the proper governmental agencies be urgently requested to draft and enforce regulations to insure a fair and equitable distribution of available petroleum and anti-knock ingredients among all members of the industry.

* * *

III. WHEREAS, An available supply of crude oil in this country is seriously limited due to the continued bungling by governmental authority and such continuance will impair the war effort and force many of the industry into oblivion;
BE IT RESOLVED THEREFOR, That
(1) the price of crude oil be immediately increased by 35c per bbl. as recommended by the Petroleum Administration for War,
(2) that the immediate steps be taken toward the development of importation facilities,
(3) and any other action be instituted to insure the immediate increase in the supply to this country of crude petroleum;
BE IT FURTHER RESOLVED, That any increase in cost be passed on the ultimate consumer;
That the Secretary of this Association be instructed to send a copy of this resolution to the President of the United States, Senators and Congressmen representing the State of Michigan.

* * *

IV. WHEREAS, The available manpower of the wholesaling branch of the petroleum industry is seriously decreased to the point that the mission of the industry and the war effort is gravely affected; and
WHEREAS, The unique position of this particular arm of the industry makes the present available reasonable plan inadequate;
BE IT RESOLVED THEREFORE, That the United States Manpower Commission be requested to declare the wholesale branch of the industry as essential nationally.

* * *

V. WHEREAS, it has been proposed that the roll-back system of handling petroleum coupons be invoked into practice;
BE IT RESOLVED THEREFORE, That the present system of coupon banking is completely more satisfactory and that it be retained by the administrative agencies of the government.

WAR OIL ORDERS

(*Continued from p. 14*)

at post. Government mileage administrator must approve official business travel applications. Lacking such officials, the commanding officer must certify to necessity for C ration, and that it will provide transportation for as many passengers as vehicle can accommodate.

RO 5C, Am. 76—Renewals of transport rations (for vehicles having a certificate of war necessity) for the fourth quarter of 1943 in the restricted area shall be on basis of full amount specified by ODT for buses, taxis, ambulances, hearses, and vehicles for public rental, and, for all other commercial vehicles, the maximum specified for period after 6-1-43, or lacking such specification, 60% of full ration. Issued 9-25, effective 9-30.

RO 5C, Supp. 1, Am. 9—Class "B" & "C" coupons in Area B and in shortage area reduced in value to 2 gallons. "A" coupons in same area worth 3 gallons. Definition of "Restricted Area" revoked. Issued 9-30, effective 10-1.

RO 11, Am. 81—Owners of new space heaters in 20 western Idaho counties are granted fuel oil rations, as an exception to the "additional facility" ration prohibition, since this area, which was formerly exempt from stove rationing under RO 9, is now included under new RO 9A. Issued 9-29, effective 10-4.

War Production Board

L-51, as am. 9-25-43—Permanent types antifreeze made available for passenger automobiles beginning Oct. 1, preferred users having been given, by former restrictions, first opportunity of obtaining supply. Issued 9-25, effective 10-1.

L-70—Revoked and reissued as PAO 17—see above. Issued 9-29.

L-79, as am. 9-25-43, Interp. 1 — L-79 exempts from preference rating requirement (A-10 or higher) equipment rationed by OPA, which includes: cooking and heating stoves using as fuel coal, gas, wood or oil (including kerosine and gasoline), combination and bungalow ranges (unless electricity is one of the fuels), coal or wood laundry stoves without built-in water jacket or coils, conversion burners (to convert coal or wood ranges to use of kerosine or oil), kitchen heater ranges, and oil table stoves. Issued 9-25.

L-199—New hot water tanks may be delivered only on orders rated A-10 or higher. Except on defense orders, types restricted to specifications of Schedul s. A, B, C, D, which add for first time porcelain-enameled range boilers and black or galvanized iron storage tanks. Materials in produc r's inventory before 12-1-43 exempt from newest restrictions, as well as tanks already processed so far as to make compliance impracticable. Use of copper prohibited in repairs, unless equal amount from old tank turned in as scrap. Monel metal and stainless steel must be repaired or turned in. Tanks of these materials in inventory may replace only non-ferrous tanks at least equal in size. Manufacture of metal jackets and supports prohibited. Issued 9-22.

L-211, Schedule 9—Word "Seamless" deleted from heading of first casing table, which now reads "Casing, Grade J-55". No other changes. Issued 9-25.

SO P-135-A, as am. 9-28-43—Requires certification of end use by laboratories ordering reagent chemicals for analysis, testing, control, educational or research purposes, whether on small orders exempted by any WPB chemicals order or not. Each laboratory is a separate person for purposes of small order exemption provisions, and may, if applicable WPB order permits, receive, without certification, delivery of that chemical in quantity not exceeding 10% of amount permitted to be delivered without specific authorization. Issued 9-28.

Rubber Order R-1, Am. 4—Permitted uses of crude rubber and natural latex cement clarified. Certification of use must accompany all purchase orders for over 12 gal. monthly, the maximum allowed for repair of shoes and of goods in which rubber, synthetic rubber, and balata may be used. Issued 9-27.

Pri Reg. 3, Am. 2 to 8-10 version—Laboratory instruments and equipment coming under P-68 (MRO, Iron & Steel Production) excepted from List B prohibitions of Pri. Reg. 3 priorities assistance. Issued 9-27.

Office of Defense Transportation

GO ODT 21 Am. 9—Certificate of War Necessity for commercial motor vehicles may be revoked for good cause, including wilful noncompliance with terms of certificate or any ODT order concerning it, fraud in obtaining it, or falsification of records; cessation of operation of vehicle for same purpose, voluntarily or upon prohibition by ODT; or erroneous issuance. Appeal may be had as provided by ODT administrative orders on procedure. Iss. 9-24, eff. 10-1.

AO ODT 5—Certif. of war necessity may be cancelled for good cause as defined in GO ODT 21 (see above). District manager institutes suspension proceedings on his own motion, furnishing holder with sworn statement of basis for proceeding. Holder who is not required to appear in person may file written statement of his position, or sworn statement on his behalf. On adverse order entered against him, holder may file written objections, which constitutes an appeal to regional director, and may request an oral hearing. Stenographic transcript will be made of proceedings. Decisions satisfactory to holder may be appealed to ODT Director in Washington. Issued 9-24, effective 10-1.

AO ODT 6—Establishes 9 regions, subdivided into 50 districts, of the Division of Motor Transport and of Division of Local Transport, both divisions headed by an Office of Regional Director in each region. Each district headed by a district manager. Issued 9-24, effective 10-1.

AO ODT 8—Procedure outlined for appeal from conditions of certificates of war necessity if holder believes his allotment insufficient for essential transportation. Application for review to be filed with district manager of ODT, who may also originate review of outstanding certificates when information in his possession warrants. Holder may appeal from district manager's decision to regional director, and, lacking satisfaction, may re-appeal to Director of ODT at Washington. Farm vehicle operator has option of filing application for review or appeal with local County War Board Farm Transportation Committee of U. S. Dept. of Agriculture. Gasoline rations may be reviewed and recalled by the district manager, who shall destroy excess coupons upon their surrender to him, and report to OPA. Issued 9-24, effective 10-1.

War Labor Board

WLB GO 4—Employers of a total of less than 8 employees in all plants or units exempt from rule of WLB approval of wage increases. Not exempt if adjustments effecting 8 specific employees made since last October. Not applicable to employers whose employees' wages, hours, etc. have been negotiated on a group or area basis by a master contract. Regional boards may recommend exceptions for their regions necessary to effectuate NWLB stabilization policies. Adopted 9-16.

Executive Orders

E. O. 9381 (amending E. O. 9250)—No employer permitted to decrease salary below highest salary for same work between 1-1-42 and 9-15-42, if result would be to reduce it below $5000 per year. $25,000 salary limitation provision removed. Issued 9-25.

OPA Fixes Anti-Freeze Prices For Shell Chemical Co.

NPN News Bureau

WASHINGTON—Shell Chemical Co., San Francisco, is permitted by OPA to charge non-retailers of isopropyl-alcohol base anti-freeze a ceiling price of 38c gal. delivered, tank cars, and 46.5c gal. delivered in drums in carload lots, including containers, and 49.5c gal. l.c.l. lots, in Order No. 3 under MPR 170, effective Sept. 23.

WAR! and OIL PRICES

Oil prices . . . the backbone of the industry . . . can either make or break your business. Today prices are subject to change. Government ceilings don't "fix prices," but merely put on a roof. Prices can be, and are often, below those ceilings—and, cost to the buyers, which is price plus extras, can be above them.

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OILGRAM

DAILY PRICE SERVICE

1213 W. 3rd St., Cleveland 13, Ohio

This 24 sheet poster appearing in Cities Service Marketing Areas this month features the new WEATHER-IZE service for Winter

World Oil News

The following information is from "The Petroleum Times", English publication, and is reprinted here because of its significance in relation to world oil developments.

The Times believes Vice President Wallace had crude oil in mind when in commenting on President Roosevelt's recent speech in Ottawa, he said "we might well take a second look before applying the fourth paragraph (of the Atlantic Charter) to the aggressor nations immediately after the war".

The paragraph of the Atlantic Charter referred to is the one under which all nations, victor or vanquished, are to enjoy access, on equal terms, to the trade and raw materials of the world.

° ° °

A recent Portuguese decree authorized naval construction of a 10,000-ton tanker. It was agreed that the tanker could be sold to private owners during or after construction was completed if no longer needed by the naval forces.

° °

Tanker barges of a new shallow bow type are being built by a Vienna Danube yard for Rumanian account said to have been evolved by the Hamburg Ship Testing Station in co-operation with the Rhine Shipyard Ruthof & Co. Dead weight capacity of the barges varies between 873 and 1120 tons. They are said to have a uniform draught of 7½ feet.

° ° °

Cases of poisoning though inhalation of producer-gas are become so numerous in Sweden as to engage the closest attention of authorities. A special hospital department has been established at Stockholm to deal exclusively with such cases. Producer-gas poisoning is now recognized as a typical professional disease to which motorists are liable. It is noted that a recent report showed 72,000 motor vehicles in Sweden are propelled by producer-gas.

° ° °

Negotiations leading to the development of oil resources in British Columbia have reached an impasse due to failure of agreement between the Dominion and British Columbia governments. The Dominion had made a proposal in behalf of the oil producing companies for possible development of the promising Lone Mountain struction in northern British Columbia which the British Columbia government would not accept.

° ° °

News of increases in Soviet oil production together with arrangements for training many thousands of oil workers provide evidence of war-time expansion in this vital industry. Also reported is rapid development of new oil fields in the Volga-Urals region extending down to the Caspian Sea. Reports of new oil fields being opened in Central Asia continue to come in.

POSTWAR FATE OF TANKERS IS WORRY

(*Continued from p. 26*)

pensable, DSC has ruled.

The entire excess war risk insurance charge is still due the companies and has never been allowed by OPA regardless of recommendation by PAW which has asked that the government keep its promise on the reimbursement. The transportation pool has collected in authorized extra price allowances more than the sum owed by the government, but these collections are sent monthly to DSC. A mere bookkeeping arrangement, it is argued, could liquidate the claims.

Convert Liberty Ships

Another extra cost which the industry is now absorbing is in connection with the conversion of Liberty cargo ships to tank ships. In this conversion, the machinery is placed amidships, and this necessitates a tunnel through the cargo tanks for the propeller shaft. Such converted tankers are usable only for hauling a cargo of one petroleum product with flash not below 150.

More than 100 Liberty tankers have been launched so far on both the East and West Coasts. They bear the designation ET-1. These vessels, after bulkhead reinforcement, installation of proper ventilation equipment, addition of piping and other alterations, have a capacity of 65,000 bbls. each. Their over-all dimensions are about the same as the Liberty cargo boats, and the ships are readily adapted to mass production.

Land Is Reassuring

The Maritime Commission points out that its emergency tanker production program is just getting into full swing. A total of 511 new tankers of all types is scheduled through 1944, making a grand total of 661 tankers that will then have been delivered since the outbreak of war.

As to the disposition of American tankers, some reassurance is found in the statement of War Shipping Administrator Admiral Emory S. Land Sept. 27 that the chartering of U.S.-built ships to other Allied nations under the "charter pool plan" will be restricted chiefly to Liberty ships. There has been widespread concern over the possibility of the government allocating tankers to other countries either on Lend-Lease, or later in the postwar program.

The new WSA ruling was in response to a query by Schuyler Bland of Virginia, chairman of the House Committee on Merchant Marine and Fisheries who asked for "a comprehensive statement of all types of ships presumed to be delivered to any foreign government."

The fate of American tankers now in government hands is highly important to the industry. Oil companies are not interested in engaging in shipping. A tank ship is considered a plant facility just as is a pipeline, and the taking over of a tank ship is equivalent to the confiscation of a plant facility which always has value far beyond its replacement cost. The true measure of the loss of a tanker is the economic loss of the facility itself. Thus the industry would be greatly impaired in its shipping facilities even if the government compensated in full for all tankers handed over to other countries.

And in addition there would be the question of competition with remaining and new American tank ships. Wage scales are higher on American ships, and our ships operated at cheap labor rates by Greece or China or even South American countries, would constitute a competition that might put the American hauler out of business.

This threat appears somewhat removed in view of the WSA announcement, although the statement is not a clear-cut assurance of protection.

Removes Limits on Idaho's Motor Fuel Shipments

NPN News Bureau

WASHINGTON—Restrictions on shipment of motor fuel from Washington and Oregon into Idaho were lifted Sept. 30 by PAW "thereby establishing normal petroleum distribution operations in Idaho's Panhandle and Boise Valley regions."

The action was effected by issuing PAO NO. 17, which embodies all the provisions contained in former WPB Limitation Order L-70 except that affecting transportation from the 2 northwestern states into Idaho.

Deputy PAW Davies said that the action was taken to increase transportation efficiency in that area and, at the same time, to prevent hardships on independent operators in the western part of Idaho.

Normally, it was pointed out, western Idaho is supplied with oil products from California. Shipments are made by tanker to the Columbia River and are barged inland to supply terminals in Washington and Oregon.

L-70, issued by WPB on March 19, 1942, prohibited shipments of motor fuel from the states of Washington and Oregon to any point outside those states in order to preserve their then depleted stocks of petroleum products.

It had been necessary to depend on a very limited and uncertain number of tankers for the movements of petroleum from refineries in California to Washington and Oregon ports, PAW said, and this movement was in turn determined by the requirements of our armed forces in the Pacific. Such uncertain transportation, PAW added, made it necessary further to protect Washington and Oregon supplies of motor fuel and fuel oil by prohibiting the movement of motor fuel from those states so that available transportation facilities could be utilized for essential fuel oils.

Coming Meetings

OCTOBER

West Virginia Petroleum Assn., sixth annual convention Daniel Boone Hotel, Charleston, W. Va., Wed., Oct. 13.

Mid-Continent Oil & Gas Assn., annual convention, Fort Worth, Tex., Wed.-Thurs., Oct. 13-14.

Indiana Independent Petroleum Assn., Inc., Hotel Severin, Indianapolis, Ind., Wed.-Thurs., Oct. 13-14.

National Assn. of Credit Men, petroleum division, annual fall conference, Coronado Hotel, St. Louis, Mo., Mon.-Wed., Oct. 25-27.

Petroleum Division, National Assn. of Credit Men, St. Louis, Mo., Mon.-Wed., Oct. 25-26-27.

Independent Petroleum Assn. of America, 14th annual meeting, Blackstone Hotel, Fort Worth, Mon.-Wed., Oct. 25-27.

American Gas Assn., 25th annual meeting, Jefferson Hotel, St. Louis, Mo., Tues.-Thurs., Oct. 26-28.

Virginia Oil Men's Assn., meeting, Patrick Henry Hotel, Roanoke, Va., Wed., Oct. 29.

NOVEMBER

National Lubricating Grease Institute, annual meeting, Edgewater Beach Hotel, Chicago, Ill., Mon.-Wed., Nov. 1-2-3.

American Petroleum Institute, annual meeting Palmer House, Chicago, Ill., Mon.-Thurs., Nov. 8-11.

Ohio Petroleum Marketers Assn., Inc., annual meeting, Hotel Deshler-Wallick, Columbus, O., Wed.-Thurs., Nov. 3-4.

South Dakota Independent Oil Men's Assn., annual convention, Marvin Hughitt Hotel, Huron, S. D., Nov. 29-30.

2 Marketing Analysts Sought By PAW in Washington

NPN News Bureau

CHICAGO—The Seventh U. S. Civil Service District, located here, is seeking for PAW two oil marketing analysts for positions described as "senior marketing research analyst" (paying $4600 plus overtime) and "marketing analyst" ($3800 plus overtime). Both jobs are open in PAW's Washington headquarters.

Persons selected will make statistical studies of demand patterns for petroleum products by area and by time series, and, in addition, make periodical estimates of projected demand patterns.

Qualifications are: Technical knowledge of statistics acquired either through formal education or experience, plus self study; experience as a statistician or economist with a petroleum company engaged in the distribution of petroleum products at the retail level. "A salesman or a manager of a petroleum firm is not wanted for this position," the announcement by civil service states.

The difference in the qualifications for the two positions, paying $3800 and $4600, is a difference in the degree of responsibility assumed.

To apply, write E. E. Alexander, Room 1056, New Post Office Bldg., Chicago 7, or if living in the vicinity of Chicago, phone Mr. Alexander at WABash 9207, Ext. 399, for an appointment.

Market Reports

MID-CONTINENT — Grade 26-70 natural gasoline prices settled down the latter part of the week with sales of 4 cars reported at 4.5c, f.o.b. Group 3, and 4 cars at 4.125c, f.o.b. Breckenridge, Sept. 28 through Oct. 1. Sept. 25, 1 seller reported sales of 6 cars at 4.25c, f.o.b. Group 3, and 1 car at 3.875c, f.o.b. Breckenridge. Sept. 27, no sellers reported quoting Grade 26-70 natural gasoline for open spot sale from either origin.

Low of price range for Ethyl gasoline in North Texas was advanced 0.25c when refiner who lowered his quotation of 7c to 6.75c Sept. 13, reported raising it to original posting. Other refiners quoted 7c also, making flat price for the product.

° ° °

CALIFORNIA—Spot gasoline market is strong. Extreme bottom on spot sales is 5.5c, 6c and 7c for 3 grades. However, most independent refiners are quoting ½c above the extreme lows. Fuel oil continues in demand with extreme bottom at $1.00 per barrel.

° ° °

MID-WEST — While refiners' prices have shown no change, strong competition for what little material is available in the Southwest and in the local markets has forced tank car marketers' prices up to ceilings on gasoline in majority of cases. Three raised 5.875c quotations on regular gasoline to 6c last week and one raised 5.125c quotation on 60 oct. gasoline to 5.25c. Approach of cold weather was heralded by rush for burning oils with supplies continuing short. Refiners and marketers reported tank car shortage because of the number carrying gasoline to east coast.

° ° °

PENNSYLVANIA—Neutrals were reported active as demand increased for winter oils. Refiner hiked his quotations 1c to 26.5c and 24.5c for 200 and 150 vis. 25 pt. neutrals respectively. Price ranges remained unchanged. Crude cuts for October resulted in scarcity of fuel oils and kerosine. Gasoline continues "critical".

° ° °

ATLANTIC COAST — Improvement in gasoline inventories reported by suppliers although quotas remain unchanged. Heating fuels reported "building up" in some areas, and residuals plentiful. Quotations at all points unchanged.

° ° °

GULF COAST—All refined products in strong demand as refineries are reported running low. No changes in quotations reported.

CRUDE PRICES

Since changes in crude oil prices are so few, the 2 pages of crude oil price tables hereafter will be printed only when there are sufficient changes in prices to warrant.

In the meantime a record is being kept in the Cleveland office of NPN and OILGRAM from which the publishers will be glad to make proofs, or letters or affidavits as to what the prices are, and without charge to regular subscribers. Changes in crude oil prices will be specially noted in this market section when made.

Crude Price Changes

Rock Island Oil Co. reported new price schedule for Stephens, Carter and Garvin counties in Oklahoma, beginning with 85c for 20 & below with 2c differential to 40 & above at $1.25, effective Oct. 1.

Magnolia Petroleum Co. reported new schedule for crude in Oklahoma beginning with 85c for Below 21 gravity with 2c differential to 40 & above at $1.25.

Cosco Oil Co. and Shell Oil Co. report same schedule as Magnolia for Oklahoma and Kansas effective Oct. 1.

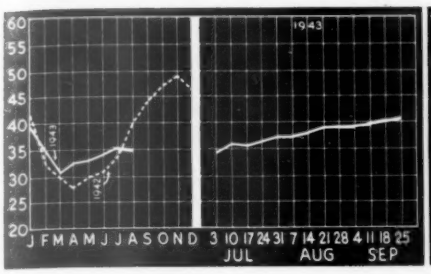
Gasoline Consumption by States, June 1943

American Petroleum Institute figures, 000 omitted

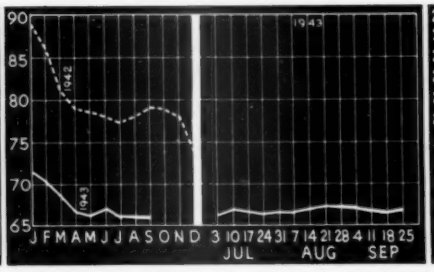
	Month of June, 1943 Gallons	Month of June, 1942 Gallons	% Change June '43 from June '42
Alabama	22,069	26,017	—15.17
Arizona	10,300	10,895	— 5.46
Arkansas	15 204	17,641	—13.81
California	210,041	213,124	— 1.45
°Colorado			
Connecticut	20,742	27,881	—25.61
Delaware	4.219	4 837	—12.78
District of Columbia	8.713	12.699	—31.39
Florida	31,013	32 224	— 3.76
Georgia	28.768	29,891	— 3.76
Idaho	8 674	9.556	— 9.23
Illinois	119.149	129 511	— 8.0
Indiana	63 621	68,739	— 7.45
Iowa	48,708	52,049	— 6.42
Kansas	45 403	46 602	— 2.57
Kentucky	19,774	23 952	—17.44
Louisiana	24.102	24 970	— 3.48
Maine	8,171	11,805	—30.78
Maryland	23 656	25,550	— 7.41
Massachusetts	40 948	50.614	—19.1
Michigan	92.352	106.845	—13.56
Minnesota	42.412	48 714	—12.94
Mississippi	19 943	20 144	— 1.0
Missouri	47,712	57.973	—17.70
Montana	9 616	11,532	—16.61
Nebraska	19.600	20,697	— 5.30
Nevada	3.246	4.397	—26.18
New Hampshire	4.879	6.505	—25.0
New Jersey	60 282	70.222	—14.16
New Mexico	8.747	9 431	— 7.25
New York	107 228	133 642	—19.76
North Carolina	27 909	35.073	—20.43
North Dakota	13.659	15.737	—13.20
Ohio	111.709	132.984	—16.0
Oklahoma	41,862	39,880	+ 4.97
Oregon	22 071	23 596	— 6.46
Pennsylvania	82.211	121.394	—32.28
Rhode Island	9,158	9,677	— 5 36
South Carolina	16 284	18 755	—13.18
South Dakota	13.625	13 570	+ .41
Tennessee	24 558	26.293	— 6.60
Texas	233 840	153,233	+52.61
Utah	8.903	10,072	—11.61
Vermont	3 361	4.423	—24.01
Virginia	29,985	33,720	—11.08
Washington	34.606	38,165	— 9.33
West Virginia	11 102	19 031	—41.36
Wisconsin	44 277	51,645	—14.27
Wyoming	4,332	5,450	—20.51
Total	1,902.744	2,061.357	7.69
Daily Average	63,425	68,712	
Change from previous year:			
Total Change	—158 613		
Percentage change in Daily Av.	—7.69%		

°Not available at time of publication.

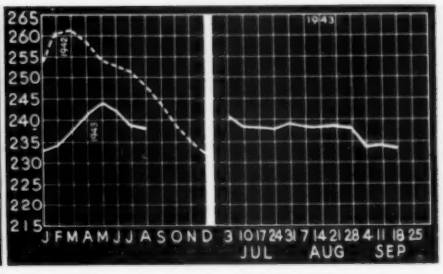
Gas Oil and Distillate Stocks



Residual Fuel Oil Stocks



Crude Stocks



Refinery Operations

(American Petroleum Institute figures in thousands of barrels of 42 gal. each. Figures include reported totals plus estimate of unreported amounts and are therefore on a Bureau of Mines basis.)

Districts	Daily Potential Refining Capacity Week Ended		Per Cent of Refining Capacity Reporting Week Ended		Daily Average Crude Runs to Stills Week Ended		Per Cent of Reporting Capacity Operated Week Ended	
	Sept. 25	Sept. 18	Sept. 25	Sept. 18	Sept. 25	Sept. 18	Sept. 25	Sept. 18
Combined°°	2,444	2,444	88.7	88.7	2,060	2,094	84.3	85.7
Appalachian (Dist. No. 1)	130	130	83.9	83.9	102	109	78.5	83.8
Appalachian (Dist. No. 2)	47	47	87.2	87.2	56	51	119.1	108.5
Ind., Ill., Ky.	824	824	85.2	85.2	717	771	87.0	93.6
Okla., Kans., Mo.	416	416	80.1	80.1	350	339	84.1	81.5
Rocky Mt. (Dist. No. 3)	8	8	26 9	26 9	8	8	100.0	100.0
Rocky Mt. (Dist. No. 4)	139	139	57.7	57.7	104	112	74.8	80.6
California	817	817	89.9	89.9	759	725	92.9	88.7
Total U. S.—B. of M. Basis	4,825	4,825	86.4	86.4	4,156	4,209	86.1	87.2
U. S.—B. of M. Basis, Sept. 26, 1942					3,834			

Districts	Gasoline Production at Refineries inc. Natural Blended Week Ended		Stocks of Finished and Unfinished Gasoline Week Ended		Total Stocks Gas Oil & Distillates Week Ended		Total Stocks Residual Fuel Oil Week Ended	
	Sept. 25	Sept. 18	Sept. 25	Sept. 18	Sept. 25	Sept. 18	Sept. 25	Sept. 18
Combined°°	5,778	6,070	30,534	30,796	18,723	18,576	18,430	17,506
Appalachian (Dist. No. 1)	294	320	1,508	1.357	817	745	298	320
Appalachian (Dist. No. 2)	166	147	810	837	63	122	161	166
Ind., Ill., Ky.	2.644	2,694	13.594	13,935	5 944	5 898	3 406	3 416
Okla., Kans., Mo.	1,273	1,245	6,203	6,092	2,264	2,255	1,577	1,619
Rocky Mt. (Dist. No. 3)	25	28	64	60	24	24	30	29
Rocky Mt. (Dist. No. 4)	326	356	1 184	1,200	421	403	732	731
California	1,700	1,876	16,127	17,022	12,072	12,276	43,011	43,106
Total U. S.—B. of M. Basis	12,206	12,736	70,024°	71,299	40,328	40,299	67,645	66,893
U. S.—B. of M. Basis Sept. 26, 1942	11,001		78,474		45,967		79,341	

°Finished 59 841.000 bbl.; Unfinished 10.183 000 bbl.
°°Includes East Coast, Inland Texas, Texas Gulf, Louisiana Gulf, and North Louisiana-Arkansas districts. Dist. 1 inventory index is 43% of normal.

Crude Oil Stocks

(Bureau of Mines Figures in thousands of bbls.)

Grade or Origin	Sept. 18	Sept. 25	Change from Sept. 18
Penna. Grade	2,690	2 643	— 47
Other Appalachian	1,592	1,540	— 52
Lima-Michigan	1,105	1,051	— 54
Illinois-Indiana	11,269	11,642	+373
Arkansas	2,813	2 858	+ 45
Kansas	8,333	8,230	—103
Louisiana:	13,659	13.569	— 90
Northern	4,343	4 383	+ 40
Gulf Coast	9,316	9 186	—130
Mississippi	1,196	1,080	—116
New Mexico	7,902	8,035	+133
Oklahoma	35,635	35 285	—350
Texas:	101,505	101 897	+392
East Texas	21.941	22 843	+902
West Texas	22,884	22 933	+ 49
Gulf Texas	31,007	30 759	—248
Other Texas	25,673	25.362	—311
Panhandle	6,091	6 198	+107
North	6,041	6 026	— 15
South	5.240	5,089	—151
Other	8 301	8 049	—252
Rocky Mountain	12 926	12 762	—164
California	31,793	31 874	+ 81
Foreign	877	547	—330
Tot. gasoline bearing in U. S.	233 295	233 013	—282
Heavy in California	10,011	9,862	—149

U. S. Crude Oil Production

(American Petroleum Institute figures in Bbls.)

	WEEK ENDED Sept. 25 Barrels (Daily Average)	Sept. 18 Barrels (Daily Average)
Oklahoma	325 250	327,350
Kansas	296,150	296.900
Nebraska	1,800	1,800
Texas	1,838.150	1,837 650
Louisiana	360 000	360.850
Arkansas	76,300	77,350
Mississippi	48,850	48.850
Illinois	215,450	217 300
Indiana	14,400	14,950
Eastern (Ill., Ind. & Ky. excluded)	75,200	76.350
Kentucky	24,650	27,500
Michigan	56,400	58,600
Wyoming	102,950	104.350
Montana	21,750	21,300
Colorado	7,050	7,500
New Mexico	109.350	109.350
California	770,700	787,800
Total, United States	4,344,400	4,375,750

Pennsylvania Crude Runs

(Compiled by National Petroleum Assn. from reports of all companies refining Pennsylvania crude. Figures in bbls.)

Week ended	Daily Average	Week ended	Daily Average
Feb. 6	67,494	June 12	76,766
Feb. 13	69.103	June 19	68,115
Feb. 20	78.797	June 26	69,551
Feb. 27	77.285	July 3	68,542
Mar. 6	70.389	July 10	75,188
Mar. 13	73.184	July 17	73,156
Mar. 20	77,828	July 24	62,047
Mar. 27	82.224	July 31	64,011
Apr. 3	81.093	Aug. 7	57,594
Apr. 10	74.317	Aug. 14	67,191
Apr. 17	70,445	Aug. 21	79 917
Apr. 24	76 625	Aug. 28	78,000
May 1	76.555	Sept. 4	72,236
May 8	77.088	Sept. 11	72,743
May 15	79.366	Sept. 18	75,420
May 22	76,684	Sept. 25	82 851
May 29	76 488	1942 Low	67,243
June 5	71,505	1942 High	87,251

N.P.N. Gasoline Index

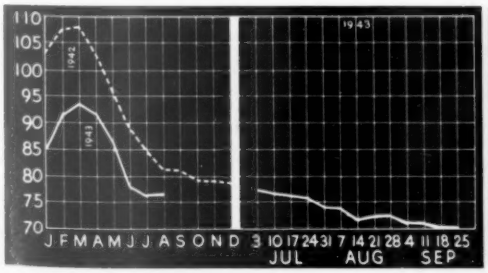
	Dealer T.W. Cents Per Gal.	Tank Car Cents Per Gal.
Oct. 4	10.43	6.92
Month ago	10.37	6.92
Year ago	10.47	6.26

Dealer index is an average of "undivided" dealer prices, ex-tax, in 50 cities.

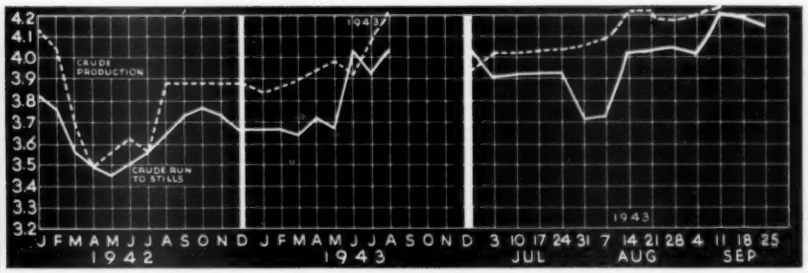
Tank car index is weighted average of following wholesale markets for regular-grade gasoline, FOB refineries or terminals: Okla., Mid-Western, W. Penna., Calif., N. Y. Harbor, Philadelphia, Jacksonville, Boston and Gulf Coast.

Gasoline Stocks

(Finished and Unfinished)



Crude Production and Runs to Stills



REFINERY and SEABOARD PRICES

IN BULK LOTS BY MOTOR TRANSPORT, TANK CAR, BARGE OR TANKER AS SHOWN

NOTE—Parenthetical figures after prices indicate number of companies quoting when less than three companies are quoting.

HOW PRICES ARE REPORTED—

Refinery and Seaboard prices in National Petroleum News are gathered by PLATT'S OILGRAM and are published in the Monday issue of the OILGRAM.

PLATT'S OILGRAM is a reporting service issued in three identical editions daily from News Bureaus at New York, Cleveland, and Tulsa, Okla. PLATT'S OILGRAM gathers and publishes what its publisher and representatives believe to be accurate news of sales, prices and current happenings affecting the oil industry and that will be of interest to its subscribers. As this information is usually private, OILGRAM reports it according to what it is able to obtain from sources deemed reliable.

All information is supplied without guarantee as to its completeness, accuracy, time of transmission or promptness of delivery.

The subscriber receives this information for his private use and not for resale or further distribution.

Publisher reserves the right to change the extent, nature and form of showing this information at any time.

Prices shown in the tables are quotations (meaning sellers' general offers or posted prices), or actual sales prices, reported to OILGRAM by refiners for "open spot" transactions, except as otherwise specified.

Prices arrived at by discounts off a specified price or "market date of shipment," prices named in contracts or prices arrived at in accordance with any arrangement made prior to date of sale, are not for "open spot" transactions and therefore are not considered in making the price tables. Prices made to brokers and prices in "Inter-refinery" transactions are also not considered except as may be noted.

All prices are for "immediate" shipment except in Gulf Coast bulk transactions where shipment is generally to be made in ninety days. Prices are FOB refineries, pipelines, or tanker terminals in districts designated.

Prices shown are for quantities in bulk such as tank car lots, motor transport lots or barge lots; and in cents per gallon; heavy fuel oils are in dollars per barrel of 42 U.S. gallons; wax and petrolatums are in cents per pound. Prices applying to barges or cargoes only are so designated.

Prices do not include taxes or inspection fees. Prices are published at the close of the business day.

Mid-Western prices in the tables were gathered from refiners with offices located in Chicago and the surrounding territory. While the prices are quoted on a Group 3 (Oklahoma) freight basis, this is in accordance with the custom of the oil industry which uses Group 3 as a price basis for the ease of comparing prices even when the material originates in another refining district. Other refinery prices are given by and for the particular refining district where the material is made and from which it is shipped.

When prices obtained by OILGRAM do not conform to these conditions the exception and the new conditions are noted in the news lead or in conjunction with the price table by footnote or otherwise, for the particular refinery or sales district involved.

Crude oil and products covered by OILGRAM'S news and price service, except where noted, have been represented to the publisher as fully up to the customary trade specifications indicated and according to the generally accepted methods of test; and all crude oil and all products thereof as having been lawfully produced and transported.

Any apparent error should be reported to the nearest OILGRAM or National Petroleum News office at once as no correction will be made after the second issue of the OILGRAM or National Petroleum News following its publication.

NOTICE—Owing to great demand, refiners generally limit quotations to regular customers and refuse bids, though higher, from others. Refiners' prices and sales shown; bids reported in market leads.

Summary of Daily Gasoline Prices (September 27 to October 4)

U. S. Motor (ASTM octane) 78 oct. no Ethyl:	Monday Oct. 4	Friday Oct. 1	Thursday Sept. 30	Wednesday Sept. 29	Tuesday Sept. 28
Oklahoma	6.75 – 6.875	6.75 – 6.875	6.75 – 6.875	6.75 – 6.875	6.75 – 7.25
Mid-western (Group 3 basis)	6.75 – 7.25	6.75 – 7.25	6.75 – 7.25	6.75 – 7.25	7
N. Tex. (For shpt. to Tex. & N. M. dest'ns.)	7	7	7	7	7
W. Tex. (For shpt. to Tex. & N. M. dest'ns.)	7 (2)	7 (2)	7 (2)	7 (2)	7 (2)
72-74 octane:					
Oklahoma	6	6	5.875– 6	5.875– 6	5.875– 6
Mid-Western (Group 3 basis)	6	6	6	6	5.875– 6
N. Tex. (For shpt. to Tex. & N. M. dest'ns.)	6	6	6	6	5.875– 6
W. Tex. (For shpt. to Tex. & N. M. dest'ns.)	6	6	6	6	6
63-66 octane:					
Oklahoma	5.625 (2)	5.5 – 5.625	5.5 – 5.625	5.5 – 5.625	5.5 – 5.625
Mid-Western (Group 3 basis)	5.6 – 5.625	5.5 – 5.625	5.5 – 5.625	5.5 – 5.625	5.5 – 5.625
N. Tex. (For shpt. to Tex. & N. M. dest'ns.)	5.625 (2)	5.625 (2)	5.625 (2)	5.625 (2)	5.5–5.625 (2)
W. Tex. (For shpt. to Tex. & N. M. dest'ns.)	5.75 (1)	5.75 (1)	5.75 (1)	5.75 (1)	5.75 (1)
60 octane & above:					
Oklahoma	5.25	5.125– 5.25	5.125– 5.25	5.125– 5.25	5.125– 5.25
Mid-Western (Group 3 basis)	5.2 – 5.25	5.2 – 5.25	5.2 – 5.25	5.2 – 5.25	5.1 – 5.25
N. Tex. (For shpt to Tex. & N. M. dest'ns.)	5.2 – 5.25	5.2 – 5.25	5.2 – 5.25	5.2 – 5.25	5.125– 5.25
W. Tex. (For shpt. to Tex. & N. M. dest'ns.)	5.25	5.25	5.25	5.25	5.25
Motor Gasoline, 72-74 octane (ASTM)					
New York harbor	9.2 – 9.4	9.2 –10.2	9.2 –10.2	9.2 –10.2	9.2 –10.2
New York harbor, barges	9.1 – 9.3	9.1 – 9.3	9.1 – 9.3	9.1 – 9.3	.1 – 9.3
Philadelphia district	9.2	9.2 – 9.7	9.2 – 9.7	9.2 – 9.7	9.2 – 9.7
Baltimore district	8.95	8.95	8.95	8.95	8.95
Motor Gasoline:					
Western Penna. Bradford-Warren:					
"Q" Gasoline, Min. 70 Oct. (ASTM)	7.5 – 8.95	7.5 –7.75 (2)	7.5 – 8.95	7.5 – 8.95	7.5 – 8.95
Western Penna. Other Districts:					
"Q" Gasoline, Min. 70 Oct. (ASTM)	7.5 – 7.75	7.5 – 7.75	7.5 – 7.75	7.5 – 7.75	7.5 – 7.75

REFINERY PRICES

Gasoline—U. S. Motor (ASTM) except where otherwise specified

Prices in Effect	Oct. 4	Sept. 27
OKLAHOMA		
78 oct. Ethyl	6.75 – 6.875	6.75 – 6.875
72-74 oct.	6	6
63-66 oct.	5.625 (2)	5.625 (2)
60 oct. & below	5.25	5.25
60-62, 400 e.p.	5.25 (1)	5.25 (1)
MID-WESTERN (Group 3 basis)		
78 oct. Ethyl	6.75 – 7.25	6.75 – 7.25
72-74 oct.	6	6
63-66 oct.	5.6 – 5.625	5.6 – 5.625
60 oct. & below	5.2 – 5.25	5.2 – 5.25
N. TEX. (For shpt. to Tex. & N. M. dest'ns.)		
78 oct. Ethyl	7	6.75 – 7
72-74 oct.	6	6
63-66 oct.	5.625 (2)	5.625 (2)
60 oct. & below	5.2– 5.25	5.2– 5.25
60-62 400 e.p.	5.375 (1)	5.375 (1)
W. TEX. (For shpt. to Tex. & N. M. dest'ns.)		
78 oct. Ethyl	7 (2)	7 (2)
72-74 oct.	6	6
63-66 oct.	5.75 (1)	5.75 (1)
60 oct. & below	5.25	5.25
CENT. W. TEX. (Prices to truck transports)		
80 oct. & above	7 (2)	7 (2)
72-74 oct.	6 (2)	6 (2)
67-69 oct.	....	....
62 oct. & below	5.25 (2)	5.25 (2)
AMARILLO, TEX. (For shpt. to W. Okla. & Tex. differential territory.)		
60 oct. & below	No Price	No Price
60-62, 400 e.p.	No Price	No Price
KANSAS (For Kansas destinations only)		
78 oct. Ethyl	7.25 (1)	7.25 (1)
72-74 oct.	6 – 6.3 (2)	6 –6.3 (2)
63-66 oct.	5.625–5.9 (2)	5.625–5.9 (2)
60 oct. & below	5.25 – 5.5 (2)	5.25 –5.5 (2)

Prices in Effect	Oct. 4	Sept. 27
ARK. (For shipment to Ark. & La.)		
72-74 oct., leaded	6 (1)	6 (1)
70-72 oct. "	5.875 (1)	5.875 (1)
62 oct. "	5.5 (1)	5.5 (1)
60 oct. & below, leaded	5.5 (1)	5.5 (1)
WESTERN PENNA. (Motor gasoline)		
Bradford-Warren:		
"Q" Gasoline, Min. 70 Oct. (ASTM)	7.5 – 8.95	7.5 – 8.95
Other districts:		
"Q" Gasoline, Min. 70 Oct. (ASTM)	7.5 – 7.75	7.5 – 7.75
CENTRAL MICHIGAN (FOB Central Mich. refinery group basis for shpt. within Mich.; shpts. may originate at plants outside Central group.)		
U.S. Motor: (Oct. ASTM):		
72-74 oct.	8 – 8.5	8 – 8.5
67-69 oct.	....	....
Str. run gasoline, excluding Detroit shpt.	6	6
OHIO (S. O. Ohio quotations for statewide delivery and subject to exceptions for local price disturbances).		
72-74 oct.	8.375	8.375
CALIFORNIA U.S. Motor:		
78 oct. & above (Ethyl)	7 – 8.75	7 – 8.75
70-75 oct. (regular)	6 – 7.75	6 – 7.75
65 oct. & below (3rd grade)	5 – 6.75	5 – 6.75

Kerosine, & Gas Fuel Oils

Prices in Effect	Oct. 4	Sept. 27
OKLAHOMA		
41-43 grav. w.w.	4.375	4.375
42-44 grav. w.w.	4.5	4.5
Range Oil	4 – 4.125	4 – 4.125
No. 1 P.W.	3.875	3.875
No. 1 straw	....	....
No. 2 straw	3.625	3.625
No. 3 fuel	3.5(1)	3.5(1)
U. G. I. Gas Oil	....	....
No. 6 fuel	....	....
14-16 fuel	$0.97 (1)	$0.97
MID-WESTERN (Group 3 basis)		
41-43 grav. w.w.	4.375	4.375
42-44 grav. w.w.	4.5	4.5
Range Oil	4 – 4.1 (2)	4 – 4.1(2)
No. 1 p.w.	3.875	3.875
No. 2 straw	3.625	3.625
No. 3	3.5 (1)	3.5 (1)
No. 5	$0.85 (1)	$0.85 (1)
No. 6	$0.80 (1)	$0.80 (1)
N. TEX. (For shpt. to Tex. & N. M. dest'ns.)		
41-43 grav. w.w.	4 –4.75 (2)	4 –4.75 (2)
No. 1 P.W.	4.2 (1)	4.2 (1)
AMARILLO, TEX. (For shpt. to W. Okla. & Tex. differential territory.)		
41-43 grav. w.w.	No Price	No Price
No. 1 straw	No Price	No Price
KANSAS (For Kansas destinations only).		
41-43 grav. w.w.	No Price	No Price
42-44 grav. w.w.	4.7–4.875(2)	4.7–4.875(2)
No. 1 p.w.	4.1–4.25(2)	4.1–4.25(2)
No. 6 fuel	$0.85 (1)	$0.85 (1)

(Continued next page)

NOTE—Parenthetical figures after prices indicate number of companies quoting when less than three companies are quoting.

NOTICE—Owing to great demand, refiners generally limit quotations to regular customers and refuse bids, though higher, from others. Refiners' prices and sales shown; bids reported in market leads.

Kerosine, & Gas Fuel Oil

(Continued)

Prices in Effect	Oct. 4	Sept. 27
ARK. (For shipment to Ark. and La.)		
41-43 grav. w.w.	4.625 (1)	4.625 (1)
No. 1	4 (1)	4 (1)
No. 2	3.5 (1)	3.5 (1)
No. 3 fuel	3.5 (1)	3.5 (1)
Tractor fuel, for shpt. to Ark. points only	5.125 (1)	5.125 (1)
WESTERN PENNA.		
Bradford-Warren:		
45 grav. w.w.	6.55 – 8.05	6.55 – 8.05
46 grav. w.w.	6.675 (1)	6.675 (1)
No. 1 fuel	6.55 – 8.05	6.55 – 8.05
No. 2 "	6.625–7.625(2)	6.625–7.625(2)
No. 3 "	6.625–7.75 (2)	6.625–7.75 (2)
36-40 gravity	6.625–6.75 (2)	6.625–6.75 (2)
Other districts:		
45 grav. w.w.	6.75 – 7.925	6.75 – 7.925
46 grav. w.w.	6.875– 7	6.875– 7
47 grav. w.w.	7 – 7.5	7 – 7.5
No. 1 fuel	6.5 – 6.625	6.5 – 6.625
No. 2 "	6.5 – 7.125	6.5 – 7.125
No. 3 "	6.5 – 7.125	6.5 – 7.125
36-40 grav., Pittsburgh dist. prices excluded	6.5 – 7	6.5 – 7
CENTRAL MICHIGAN (FOB Central Mich. refinery group basis for shpt. within Mich.; shpts. may originate at plants outside Central group.)		
47-49 gravity w.w.	5.8 – 6	5.8 – 6
P.W. Distillate	5.5	5.5
No. 3 gas oil, Straw	5	5
U.G.I. gas oil	4.5 (2)	4.5 (2)
Fuel Oils (*Vis. at* 100).		
300-500 Vis.	....	....
100-300 Vis.	4.5	4.5
OHIO (S. O. quotations for statewide delivery)		
Kerosine	7	7
CALIFORNIA		
40-43 grav. w.w.	7	5 – 7
San Joaquin Valley:		
Heavy fuel	$1.10 (2)	$1.10 (2)
Light fuel	$1.20 (2)	$1.20 (2)
Diesel fuel	4 (2)	4 (2)
Stove dist.	5 (2)	5 (2)
Los Angeles:		
Heavy fuel	$1.10 (2)	$1.10 (2)
Light fuel	$1.20 (2)	$1.20 (2)
Diesel fuel	4 (2)	4 (2)
Stove dist.	5 (1)	5 (1)
San Francisco:		
Heavy fuel	$1.15 (1)	$1.15 (1)
Light fuel	$1.25 (1)	$1.25 (1)
Diesel fuel	4.5 (1)	4.5 (1)
Stove d'st.	5.5 (1)	5.5 (1)

NOTE: All above heavy fuels meet Pacific specification 400; light fuel, spec. 300; Diesel fuels, spec. 200; and stove distillate, spec. 100.

Lubricating Oils

WESTERN PENNA.

Prices are for sales made, or offers reliably reported, to jobbers & compounders only.

Viscous Neutrals—*No. 3 col. Vis. at* 70°*F.*

200 Vis. (180 at 100°) 420-425 fl.		
0 p.t.	31.5 (1)	31.5 (1)
10 p.t.	30.5 (1)	30.5 (1)
15 p.t.	29.5 (1)	29.5 (1)
25 p.t.	25–28	25–28
150 Vis. (143 at 100°) 400-405 fl.		
0 p.t.	29.5 (1)	29.5 (1)
10 p.t.	28.5 (1)	28.5 (1)
15 p.t.	27.5 (1)	27.5 (1)
25 p.t.	23–26	23–26
Cylinder Stocks		
Brt. stk., 145-155 *vis. at* 210°, 540-550 fl., *No.* 8 *col.*		
10 p.t.	30.5 (1)	30.5 (1)
15 p.t.	29.5 (1)	29.5 (1)
25 p.t.	25	25
600 S.R. filterable	15	15
650 S.R.	15.5	15.5
600 fl.	16	16
630 fl.	17	17
MID-CONTINENT (F. o. b. Tulsa)		
Neutral Oils (*Vis. at* 100° *F. 0 to* 10 *P.P.*)		
Pale Oils:		
Vis. Color		
60-85—No. 2	8	8
86-110—No. 2	8.5 (2)	8.5 (2)
150—No. 3	14.5	14.5
180—No. 3	15	15
200—No. 3	15	15
250—No. 3	16–16.5	16–16.5
280—No. 3	17	17
300—No. 3	18 (2)	18 (2)

Lubricating Oils (Cont'd)

Prices in Effect	Oct. 4	Sept. 27
Red Oils:		
180—No. 5	15 (1)	15 (1)
200—No. 5	15 (1)	15 (1)
280—No. 5	No Price	No Price
300—No. 5	17.5 (2)	17.5 (2)

Note: Viscous Neutrals, 15-25 p.p. generally are quoted 0.5c under 0-10 p.p. oils. Non-viscous oils, 15-25 p.p.; generally are quoted 0.25c under 0-10 p.p. oils.

Bright Stock—*Vis. at* 210°

200 Vis. D	27 (1)	27 (1)
150-160 Vis. D:		
0 to 10 p.p.	23	23
10 to 25 p.p.	22.5–23	22.5–23
25 to 40 p.p.	23 (1)	23 (1)
150-160 Vis. E	22 (1)	22 (1)
120 Vis. D:		
0 to 10 p.p.	22 (2)	22 (2)
600 S.R. Dark Green	8.5 (1)	8.5 (1)
600 S.R. Olive Green	10–11	10–11
631 S.R.	18.5 (1)	18.5 (1)
Black Oil	5.5 (1)	5.5 (1)

QUALIFYING PRICE NOTE: Prices on neutrals are posted prices from which refiners allow special discounts, ranging to 1c to meet varying local competition.

SOUTH TEXAS Neutral Oils

Pale Oils (*Vis. at* 100°*F.*)

Vis. Color		
100 No. 1½-2½	6.5	6.5
200 No. 2-3	8.75	8.75
300 No. 2-3	9.25	9.25
500 No. 2½-3½	10	10
750 No. 3-4	10.25	10.25
1200 No. 3-4	10.375	10.375
2000 No. 4	10.5	10.5
Red Oils:		
100 No. 5-6	6.5 (2)	6.5 (2)
200 No. 5-6	8.75	8.75
300 No. 5-6	9.25	9.25
500 No. 5-6	10	10
750 No. 5-6	10.25	10.25
1200 No. 5-6	10.375	10.375
2000 No. 5-6	10.5–11.5	10.5–11.5

CHICAGO (From Mid-Continent p.l. crude.)

Neutral oils (*Vis. at* 100° *F. 0 to* 10 *p.p.*)

Pale Oils

Vis. Color		
60-85—No. 2	9.5 (1)	9.5 (1)
86-110—No. 2	10 (1)	10 (1)
150—No. 3	15.5 (1)	15.5 (1)
180—No. 3	16 (1)	16 (1)
200—No. 3	16 (1)	16 (1)
250—No. 3	17 (1)	17 (1)
Red Oils:		
180—No. 5	16 (1)	16 (1)
200—No. 5	16 (1)	16 (1)
250—No. 5	17 (1)	17 (1)
280—No. 5	18 (1)	18 (1)
300—No. 5	18.5 (1)	18.5 (1)

Note: Viscous oils, 15 to 30 p.p. are quoted 0.5c lower: 60-85 and 86-110 No. 2 non-viscous oils, 15 to 30 p.p., 0.25c lower.

Unfiltered Steam Refined: (*Viscosity at* 210°)

140	11.5 (1)	11.5 (1)
160	12.5 (1)	12.5 (1)
200	13.5 (1)	13.5 (1)
Bright stocks, 160 *vis. at* 210 *No.* 8 *color:*		
0 to 10 p.p.	24 (1)	24 (1)
15 to 25 p.p.	23.5 (1)	23.5 (1)
30 to 40 p.p.	21.5 (1)	21.5 (1)
E filtered Cyl. Stock	15.5 (1)	15.5 (1)

Note: To obtain prices delivered in Chicago, add 0.25c per gal.

Natural Gasoline

(Group 3 & Breckenridge prices are to blenders on freight basis shown below. Shipments may originate in any Mid-Continent manufacturing district.)

FOB GROUP 3 (Grade 26-70)

Oct. 4	4.5 (Sales)
Sept. 27	No quotes or sales
Sept. 25	4.25 (Sales)

FOB BRECKENRIDGE (Grade 26-70)

Oct. 4	4.125 (Sales)
Sept. 27	No quotes or sales
Sept. 25	3.875 (Sale)

CALIFORNIA (FOB plants in Los Angeles basin)

21 pound vapor pressure for blending	4.75 – 5.375	4.75 – 5.375

Naphtha and Solvent

Prices in Effect	Oct. 4	Sept. 27
(*FOB Group* 3)		
Stoddard solvent	6.625	6.625
Cleaners' naphtha	7.125	7.125
V. M. & P. naphtha	7.125	7.125
Mineral spirits	6.125	6.125
Rubber solvent	7.125	7.125
Lacquer diluent	7.375– 8.125	7.375– 8.125
Benzol Diluent	8.375– 8.625	8.375– 8.625
WESTERN PENNA.		
Bradford-Warren District:		
Stoddard Solvent	7.5 (1)	7.5 (1)
Other Districts:		
Untreated naphtha	7 – 7.25	7 – 7.25
Stoddard solvent	7 – 7.75	7 – 7.75

OHIO (S. O. quotations for statewide delivery): V.M.&P. naphtha, D.C. naphtha, Varnolene & Sohio solvent 10 10; Rubber solvent 9 9

Wax

WESTERN PENNA. (Bbls. C.L.)

White Crude Scale:		
122-124 A.m.p.	4.25 (2)	4.25 (2)
124-126 A.m.p.	4.25	4.25

OKLAHOMA (C.L. FOB Refinery)

Semi-refined:		
128 AMP min, white, 50 kilo bags	No Price	No Price
132-134 AMP, bbls.	5.25 (1)	5.25 (1)

CHICAGO (FOB Chicago district refinery of one refiner, in bags, carloads. Carloads, slabs loose 0.4c less. Melting points are EMP (ASTM) methods; add 3° to convert into AMP.)

Fully refined:		
122-124 (bags only)	5.6	5.6
125-127	6	6
127-129	6.25	6.25
130-132	6.55	6.55
132-134	6.8	6.8
135-137	7.55	7.55

Petrolatums

WESTERN PENNA. (Bbls., carloads; tank cars, 0.5c per lb. less.)

Snow White	6.125– 7.25	6.125– 7.25
Lily White	5.375– 6.125	5.375– 6.125
Cream White	4.375– 5.375	4.375– 5.375
Light Amber	3.375– 3.875	3.375– 3.875
Amber	3.125– 3.625	3.125– 3.625
Red	3 – 3.5	3 – 3.5

Group 3 Freight Rates

To Division Headquarters Points of Standard Oil Co. of Indiana

(Cents Per Gal.)

	Gasoline Kerosine	*Distillate Fuel Oil	Gas Oil and /or Residual Fuel Oil
Chicago, Ill.	2.376	2.368	2.368
Decatur, Ill.	2.112	2.112	2.294
Joliet, Ill.	2.376	2.368	2.368
Peoria, Ill.	2.178	2.178	2.294
Quincy, Ill.	2.046	2.046	2.146
Indianapolis, Ind.	2.508	2.886	2.886
Evansville, Ind.	2.310	2.738	2.738
South Bend, Ind.	2.904	2.970	3.108
Detroit, Mich.	4.026	3.774	3.774
Grand Rapids, Mich.	3.597	3.597	3.700
Saginaw, Mich.	4.026	3.922	3.922
Green Bay, Wis.	2.706	2.706	3.034
Milwaukee, Wis.	2.574	2.553	2.553
La Crosse, Wis.	2.442	2.442	2.738
Minneapolis-St. Paul	2.442	2.442	2.738
Duluth, Minn.	2.706	2.706	3.071
Mankato, Minn.	2.442	2.442	2.738
Des Moines, Ia.	1.914	1.914	2.146
Davenport, Ia.	2.178	2.178	2.294
Mason City, Ia.	2.244	2.244	2.479
St. Louis, Mo.	1.914	1.914	1.961
Kansas City, Mo.	1.452	1.452	1.665
St. Joseph, Mo.	1.452	1.452	1.665
Fargo, N. D.	3.366	3.366	3.737
Huron, S. D.	2.838	2.838	3.145
Wichita			
From Ponca City	0.891	0.891	0.999
From Tulsa	0.891	0.891	0.999
From Cushing	0.825	0.825	0.925

*Not suitable for illuminating purposes.

SEABOARD PRICES EXPORT AND COASTWISE

Atlantic Coast

(Prices are of refiners, FOB their refineries & their tanker terminals, & of tanker terminal operators FOB their terminals.—Prices In Effect Oct. 4

MOTOR GASOLINE

District:	Min. 80 Oct. '30 Research (Max. 2 cc Lead)	72-74 Oct. (ASTM)	68-70 Oct. (ASTM)
N. Y. Harb.	....	9.2 - 9.4	9.2 (1)
N. Y. Harb., barges	....	9.1 - 9.3	9.1 (1)
Albany	....	9.3 - 9.5	....
Ph'ladelphia	....	9.2	....
Baltimore	....	8.95	8.85 (1)
Norfolk	....	8.7 - 8.95	8.5 (1)
Wilmington, N. C.	....	8.7 - 8.75	8.5 (1)
Charleston	....	8.7 - 8.8	8.1 (1)
Savannah	....	8.25 - 8.4	....
Jacksonville	....	8.27 - 8.4	....
Miami	....	8.27 (1)	....
Tampa	....	8.27 - 8.4	8.275 (1)
Pensacola	....	7 -7.2 (1)	....
Mobile	....	7 - 7.2	....
New Orleans	....	6.125- 6.75	....
Portland	....	9.5 - 9.65	....
Boston	....	9.4 - 9.7	9.7 (1)
Providence	....	9.4 - 9.7	....

	KEROSINE and or NO. 1 FUEL	No. 2	FUEL OILS No. 3	No. 5	No. 6
N. Y. Harb.	7.1	6.7	6.7	$1.95-$2.01(a)	$1.65 -$2.07
N. Y. Harb., barges	7	6.6	6.6	....	....
Albany	7.3	6.8	6.8 (2)	$2.25 (1)	$1.85-$2.27 (1)
Philadelphia	7.2	6.7	6.7	$1.98	$1.65 -$2.07
Baltimore	7.2	6.7	6.7	....	$1.65 -$2.07
Norfolk	7.1	6.7	6.7 (1)	....	$1.65-$2.07 (2)
Wilmington, N. C.	7.05	6.7	....	....	....
Charleston	7.2	6.7 (2)	....	....	$1.60 $2.02 (2)
Savannah	7.05	....	....	....	$1.60 $2.02 (1)
Jacksonville	7.05	6.25	....	....	$1.60 $2.02 (1)
Miami	7.05 (2)	....	....	....	....
Tampa	7.05	6.25 (2)	....	....	$1.50-$1.92 (2)
Pensacola	4.8 (1)	....	....	....	....
Mobile	4.75-5.05 (2)	....	....	....	....
New Orleans	4.25 - 4.75	3.75 (2)	....	$1.27 (1)	$0.85 $1.27 (2)
Portland	7.3	6.8	6.8 (2)	$2.25 (1)	$1.65 $2.07 (1)
Boston	7.2	6.7	6.7 (2)	$1.95-$2.07 (2)	$1.65 $2.07
Providence	7.2	6.7	6.7 (2)	$1.90-$1.95 (2)	$1.65-$2.07

(a) This price is for a straight-run low pour test No. 5 fuel.

	Bunker C Fuel Ships' bunkers (Ex Lighterage)	Diesel Oil Ships' bunkers (Ex Lighterage)	Diesel Oil Shore Plants	Gas House Gas Oil 28-34 Gravity
N. Y. Harbor	$1.65-$2.07	$2.78	6.7 6.8 2)	6.8 (2)
Albany	$1.85 (1)	$2.98 (1)	6.8 (1)	6.7
Philadelphia	$1.65-$2.07	$2.78	....	....
Baltimore	$1.65-$2.07	$2.78	6.7 (1)	6.7 (1)
Norfolk	$1.65-$2.07	$2.78	6.7 (1)	6.7 (1)
Charleston	$1.60-$2.02	$2.78 (2)	6.7 (1)	6.7 (1)
Savannah	$1.60-$2.02 (1)	$2.62 (1)	....	....
Jacksonville	$1.60-$2.02 (2)	$2.62 (2)	....	....
Tampa	$1.50-$1.92	$2.62 (2)	....	....
New Orleans	$0.97-$1.09	$1.65 (1)	4 (1)	....
Portland	$1.65-$2.07 (1)	$2.86 (2)	6.8 (1)	6.9 (1)
Boston	$1.65-$2.07	$2.78	6.7 (2)	6.8 (2)
Providence	$1.65-$2.07	$2.78 (2)	6.7 (1)	6.8 (1)

Residual fuel prices generally vary with A.P.I. specifications from range low for 9.9 & below degrees to range high for 25.0 & above.

Gulf Coast

Prices in Effect Oct. 4

MOTOR GASOLINE	New Orleans & Lower Mississippi to Baton Rouge Tank Cars	Barge	Texas Gulf Coast South of New Orleans Tank Cars	Barges	CARGOES Domestic & Export From Gulf Ports
Leaded (oct. by ASTM)					
80 oct. min. Max. 3 cc lead	6.5 - 6.75	6.5 - 6.75	6.75	6.75	6.25 - 6.75
72-74 oct.	6.125	5.75	5.75	5.75	5.75
63-65 oct.	....	....	....	....	....
Unleaded 70 oct.	....	....	....	....	5.625- 5.75
67-68 oct.	....	....	....	....	5.5 - 5.625
65 oct.	....	....	....	....	5.25
60 oct.	....	....	....	....	5
KEROSINE & LIGHT FUELS					
41-43 w.w. kero.	4.125- 4.25	4.125	4.125- 4.25	4.125	4.125
42-44 w.w. kero.	....	....	4.125	4.125	4.125
No. 2 fuel oil	3.75	3.75	3.75 - 4	3.75	3.75
DIESEL & GAS OILS					
(In diesel index No.)					
Below 43 di.	....	....	....	....	....
43-47 di.	....	....	....	....	4
48-52 di.	4	4	4	4	4
53-57 di.	4.125	4.125	4.125	4.125	4.125
58 and above	4.25	....	4.25	....	4.25

HEAVY FUELS & BUNKER OILS (At all Gulf Ports)	In Cargoes	In Ship's Bunkers (Ex lighterage)
Heavy Diesels		
Below 28 API Grav.	....	$1.35
28 API Grav. & Above	....	$1.65
Bunker C Oil	$0.85-$1.27	$0.85-$1.27

Above products in Truck Transports of 2,400 gal. and over ½c above Tank Car Prices.

NOTE—Prices for heavy fuels vary within the range given above according to gravity from 9.9 grav. and below to 25 B and above.

(Quotations at seaboard, Los Angeles, cargo lots except where otherwise noted.)

Prices in Effect	Oct. 4	Sept. 27
375 e.p. blend, 70 oct.	No Price	No Price
390 e.p. blend, 68 oct.	No Price	No Price
390 e.p. blend, 66 oct.	No Price	No Price
400 e.p. blend, 65 oct. min.	No Price	No Price
U. S. Motor, under 65 oct.	No Price	No Price
38-40 grav., w.w. kero., 150 fire point	No Price	No Price
41-43 grav., w.w. kero.	No Price	No Price
44 grav. w.w. kero.,	No Price	No Price
Diesel fuel, 24 & above	No Price	No Price
Diesel fuel, under 24	No Price	No Price
30-34 grav. diesel (gas oil) Pac. Spec. 200	No Price	No Price
Grade C fuel, Pac. Spec. 400	No Price	No Price
In Ship's Bunkers, or deep tank lots:		
Diesel Fuel, Pac. Spec. 200	$1.40 -$1.45	$1.40 -$1.4
Grade C fuel, Pac. Spec. 400	$1.10	$1.10
Cased Goods: (Per case)		
375-400 e.p. blend, 65 oct. & above.	No Price	No Price
400 e.p. blend under 65 oct.	No Price	No Price
U. S. Motor	No Price	No Price
40-43 grav., w.w. kero., 150 fire point	No Price	No Price
Kero., p.w.	No Price	No Price

Naphtha

Prices In Effect Oct. 4

	V.M.&P. Naphtha	Mineral Spirits
New York Harbor	11 (2)	10
Philadelphia dist.	11 (2)	10
Baltimore	10.5 (2)	9.5
Boston	11.5 (2)	10.5
Providence	11.5 (1)	10.5 (2

Mid-Continent Lubes

(At Gulf; in packages, FAS.; in bulk, FOB terminals)

Prices in Effect Oct. 4

	Steel Drums	Bulk
200 Vis. D 210 brt. stock	35 (1)	28.8 (1
150 vis. D 210 brt. stock 0-10 p.p.	31 (1)	24.8 (1
10-25 p.p.	....	....
100 vis. D 210 brt. stock 0-10 p.p.	....	....
10-25 p.p.	....	....
200 vis. No. 3 col. neutral: 0-10 p.p.	....	....

Wax

(Melting points are AMP, 3° higher than EMP. Prices are FOB refinery and do not include bag freight or export differentials).

Prices In Effect Oct. 4

Crude Scale	New Orleans Export	N. Y. Domestic	N. Y. Export
124-6 Yellow	4.25(1)	....	4.25(1
122-4 White.	....	4.25(2)	4.25(2
124-6 White.	4.25(1)	4.25	4.25
Fully Refined:			
123-5	5.2(1)	5.2(2)	5.2(1)
125-7	5.2(1)	5.2(2)	5.2(1)
128-30	5.6(1)	5.6	5.6(1)
130-32	5.85(1)	5.85(2)	5.85(1
133-5	6.15(1)	6.15	6.15(1
135-7	6.4(1)	6.4(1)	6.4(1)

Tanker Rates

(Approximate last paid rates, cents per bbl. Gulf-N. Atlantic, not East of N. Y.)

Hvy. Crude & Fuel (10 to 19.9 gravity)	48
Light Crude, (30 grav. or Lighter)	43
Gasoline	40
Kerosine	40
No. 2 Fuel	42

NOTE: Increased wartime operating expenses in excess of above rates absorbed by War Shipping Administration.

Commercial or consumer tank car, tank wagon, dealer, and service station prices for gasoline **do not include taxes;** *they do, however, include inspection fees as shown in general footnote. Gasoline taxes, shown in separate column, include 1.5c federal, and state taxes; also city and county taxes as indicated in footnotes. Kerosine tank wagon prices also do not include taxes; kerosine taxes where levied are indicated in footnotes. Dealer discounts are shown in footnotes. These prices in effect Oct. 4, 1943 as posted by principal marketing companies at their headquarters offices, but subject to later correction.*

Atlantic Refining

Atlantic White Flash Gasoline (*Reg. Grade*)

	Commercial T.W.	Dealer T.W.	Gasoline Taxes	Kerosine T.W.
Philadelphia, Pa	10.2	10.7	5.5	12.25
Pittsburgh	10.7	11.2	5.5	12.6
Allentown	10.7	11.2	5.5	12.6
Erie	10.7	11.2	5.5	12.6
Scranton	10.7	11.2	5.5	12.6
Altoona	10.7	11.2	5.5	12.6
Emporium	10.7	11.2	5.5	12.6
Indiana	10.7	11.2	5.5	12.6
Uniontown	10.7	11.2	5.5	12.6
Harrisburg	10.7	11.2	5.5	12.6
Williamsport	10.7	11.2	5.5	12.6
Dover, Del	....	11.2	5.5	12.6
Wilmington, Del	....	10.7	5.5	12.1
Boston, Mass	....	10.9	5.5	....
Springfield, Mass	....	11.8	4.5	....
Worcester, Mass	....	11.5	4.5	....
Fall River, Mass	....	11	4.5	....
Hartford, Conn	....	11.6	4.5	....
New Haven, Conn	....	11	4.5	....
Providence, R. I	....	11	4.5	....
Atlantic City, N. J	....	10.7	4.5	10
Camden, N. J	....	10.7	4.5	10
Trenton, N. J	....	10.7	4.5	10
Annapolis, Md	....	11.05	5.5	10.8
Baltimore, Md	....	10.45	5.5	9.8
Hagerstown, Md	....	11.55	5.5	10.3
Richmond, Va	....	11.25	6.5	12.3
Wilmington, N. C.	....	11.55	7.5	11.9
Brunswick, Ga	....	10.4	7.5	11.1
Jacksonville, Fla	....	10.4	8.5	12.1

	Mineral Spirits T.W.†	V.M.&P. T.W.†
Philadelphia, Pa	11	12.5
Lancaster, Pa	12	13.5
Pittsburgh, Pa	12.5	13.5

	Fuel Oils—T.W. 1	2	3	5	6
Phila., Pa	10.1	9	9	5.76	5.33*
Allentown, Pa	10.6	9.3	9.3	....	....
Wilmington Del	10.1	9	9	....	....
Springfield, Mass.	10.2	9.4	9.4	....	....
Worcester, Mass.	10.2	9.3	9.3	....	....
Hartford, Conn.	10.5	9	9	....	....

‡Does not include 1c Georgia kerosine tax.

†Mineral Spirits prices also apply to Stoddard Solvent; V.M.&P. prices also apply to Light Cleaners Naphtha.

Discounts:

Gasoline—to undivided dealers, 0.5c off dealer t.w., except Georgia & Florida dealer t.w. and undivided dealer t.w. prices are same.

Kerosine—Thru Penna. & Delaware, 2c off t.w. price on t.w. deliveries of 25 gals. or more at one time.

*Residual fuel 16.0-19.9 gravity.

S. O. Kentucky

Crown Gasoline (*Regular*)
Standard (*Third Grade*)

	†Net Crown	Dealer Standard	Gasoline Taxes	Kerosine T.W.
Covington, Ky	9.5	...	6.5	9.3
Lexington, Ky	10.5	8.5	6.5	9.3
Louisville, Ky	10	...	6.5	8.8
Paducah, Ky	10	8	6.5	8.8
Jackson, Miss.	10	9	7.5	*9
Vicksburg, Miss.	9.5	...	7.5	*8.5
Birmingham, Ala.	10	9	*8.5	9
Mobile, Ala	9	...	*9.5	8.5
Montgomery, Ala.	10	9	*9.5	10
Atlanta, Ga	11.4	...	7.5	*12.1
Augusta, Ga	11.4	...	7.5	*11.6
Macon, Ga	11.4	...	7.5	12.1
Savannah, Ga	10.4	...	7.5	11.1
Jacksonville, Fla.	10.4	...	8.5	10.1
Miami, Fla.	10.4	...	8.5	10.1
Pensacola, Fla	9	8	*9.5	8
Tampa, Fla	10.4	...	8.5	10.1

*Taxes: In tax column are included these city and county gasoline taxes: Mobile, 2c city; Birmingham, 1c city; Montgomery, 1c city and 1c county; Pensacola, 1c city. Georgia and Montgomery, Ala. have 1c kerosine tax, Mississippi 0.5c, not included in above prices.

†Consumer t.w. prices are same as netdealer prices.

S. O. New Jersey

Esso (*Regular Grade*)

	Consumer Tank Wagon	Dealer T.W.	Gasoline Taxes	Kerosine T.W.
*Atlantic City, N. J.	10.2	10.7	4.5	10
*Newark, N. J.	10.2	10.7	4.5	10
Annapolis, Md.	10.55	11.05	5.5	....
Baltimore, Md.	9.95	10.45	5.5	10.8
Cumberland, Md.	11.35	11.85	5.5	12.3
Washington, D. C.	10.2	10.7	4.5	11.3
Danville, Va	11.65	12.15	6.5	12.55
Norfolk, Va	10.45	10.95	6.5	12.3
Petersburg, Va	10.75	11.25	6.5	13.3
Richmond, Va	10.75	11.25	6.5	13.3
Roanoke, Va	11.95	12.45	6.5	12.8
Charleston, W. Va	12.25	12.75	6.5	13.6
Parkersburg, W. Va.	11.55	12.05	6.5	13.3
Wheeling, W. Va.	11.55	12.05	6.5	13.9
Charlotte, N. C.	12.1	12.6	7.5	11.6
Hickory, N. C.	12.65	13.15	7.5	12.6
Mt. Airy, N. C.	12.5	13.0	7.5	11.8
Raleigh, N. C.	11.85	12.35	7.5	12.6
Salisbury, N. C.	12.15	12.65	7.5	13.0
Charleston, S. C.	10.95	11.45	7.5	....
Columbia, S. C.	11.8	12.3	7.5	....
Spartanburg, S. C.	12.5	13.0	7.5	....

	Mineral Spirits T.W.	V.M.&P. T.W.
Newark, N. J.	13	14.5
Baltimore, Md.	15.5	....
Washington, D. C.	15.5	....

Fuel Oils—T.W.	No. 1	No. 2	No. 3
Atlantic City, N. J.	10	9	9
Newark	10	9	9
Annapolis, Md.	..	9.25	..
Baltimore	9.8	9	9
Washington, D. C.	10.3	9.4	9.4
Norfolk, Va.	10	8.8	8.8
Petersburg	10.3	9	...
Richmond	10.3	9	9
Charlotte, N. C.	10.6	10.4	...
Hickory, N. C.	....	10	...
Raleigh	11.6	10.1	...
Charleston, S. C.	....	9	...
Columbia	....	10	...
Spartanburg	....	10.8	...

*Effective Aug. 5, '42 minimum retail resale price of 14.2c posted thru New Jersey.

Discounts:

Esso gasoline—to undivided dealers, 0.5c off dealer t.w.

Kerosine—1c off t.w. price for 25 gals. or more, under contract thru territory (Baltimore city contract not necessary) except no discount in state of New Jersey.

Naphthas—To buyers taking following quantities at one time: Newark, 2c per gal. on 200 gals. or more, less than 200 gals. 0.5c higher price; Baltimore, 2c off on 25 to 100 gals. and 3c on over 100 gals.; Washington, 2c off to contract buyers.

S. O. Ohio††

***Sohio X-70 Gasoline (*Regular Grade*)**

	Consumer T.W.	**Resellers	‡S.S.	Gasoline Taxes	†Kerosine T.W.
Ohio, Statewide	12	10	13.5	5.5	9.3
Akron	12	9.5	12.5	5.5	9.3
Cincinnati	12	9.5	12.5	5.5	9.3
Cleveland	12	9.5	12.5	5.5	9.3
Columbus	12	9.5	12.5	5.5	9.3
Dayton	12	9.5	12.5	5.5	9.3
Marietta	12	9.5	12.5	5.5	9.3
Portsmouth	12	9.5	12.5	5.5	9.3
Toledo	12	9.5	12.5	5.5	9.3
Youngstown	12	9.5	12.5	5.5	9.3

Aviation Gasoline—Statewide

	Consumer T.W.	Gasoline Taxes
Sohio aviation grade 65 octane, Spec. AN-VV-F-756	14.5	5.5
Esso Ethyl Aviation 73 Oct.	15.5	5.5
Esso Ethyl Aviation 80 Oct.	16.5	5.5
Esso Ethyl Aviation 87 Oct.(a)	17.5	5.5
Esso Ethyl Aviation 91 Oct.	17.5	5.5
Esso Ethyl Aviation 100 Oct.	24.5	5.5

(a) Effective Oct. 15, 1942.

	†Naphtha—T.W. Statewide	Lucas County
S. R. Solvent	13.5	13.5
D. C. Naphtha	14.5	14.25
V.M.&P. Naphtha	14.5	14.25
Varnolene	14.5	14.25
Sohio Solvent	14.5	14.25

Fuel Oils—T.W.	No. 1	No. 2	No. 3	No. 4
Ohio, Statewide	8.3	8.3	7.8	7.55
Cleveland	10.3	10.3	9.8	....

*Renown (third-grade) prices are same as X-70 unless otherwise noted.

**Except authorized agents.

†Kerosine prices are ex 1c state tax. Naphtha prices are ex 1.5c federal & 4c state tax.

‡Prices at company-operated stations.

††Statewide prices are subject to exceptions other than those shown.

Discounts:

Esso aviation—on contract to hangar operators and resellers, 2c off consumer t.w.

Fuel oils—Statewide prices are for t.w. & drum deliveries of 50 gals. or more; prices for deliveries of less than 50 gals. are 0.5c higher. Cleveland Division assumed the state-wide fuel oil tank wagon prices on Nos. 1, 2 and 3 fuel oil, effective May 10. However the price of 7.55c per gallon on No. 4 fuel oil (full compartment hose dumps only) will remain as heretofore, in Cleveland Division.

Naphthas—to contract consumers off t.w. prices—Statewide: 300 to 999 gals., 0.5c; 1000 to 2499 gals., 0.75c; 2500 to 4999 gals., 1c; 5000 or more gals., 1.5c. Lucas County: Less than 50 gals., tank wagon price, 50 to 249 gals., 0.5c; 250 to 499 gals., 1c; 500 gals. or over, 1.5c.

Socony-Vacuum Oil Co., Inc.

Socony Mobilgas (*Regular Grade*)

	Com. Cons. T.W.	Indiv. Dlr. T.W.	Gasoline Taxes
New York City	10.1	10.6	*5.5
Manhattan & Bronx	10.1	10.6	*5.5
Kings & Queens	10.1	10.6	*5.5
Richmond	9.7	10.2	*5.5
Albany, N. Y.	9.9	10.4	5.5
Binghamton, N. Y.	11	11.5	5.5
Buffalo	10.2	10.7	5.5
Jamestown, N. Y.	10.4	10.9	5.5
Mt. Vernon, N. Y.	10.1	10.6	5.5
Plattsburg, N. Y.	11	11.5	5.5
Rochester, N. Y.	10.8	11.3	5.5
Syracuse, N. Y.	10.5	11	5.5
Bridgeport, Conn.	10	10.5	4.5
Danbury, Conn.	10.5	11	4.5
Hartford, Conn.	10.6	11.1	4.5
New Haven, Conn.	10	10.5	4.5
Bangor, Me	10.7	11.2	5.5
Portland, Me.	10.3	10.8	5.5
Boston, Mass.	9.9	10.4	4.5
Concord, N. H.	11.4	11.9	5.5
Lancaster, N. H.	12	12.5	5.5
Manchester, N. H.	11.3	11.8	5.5
Providence, R. I.	10	10.5	4.5
Burlington, Vt.	10.9	11.4	5.5
Rutland, Vt.	11	11.5	5.5

	Mineral Spirits T.W.	V.M.&P. T.W.
Buffalo, N. Y.	12.4	13.6
New York City	11	12
Rochester, N. Y.	13.2	14.4
Syracuse, N. Y.	14	....
Boston, Mass.	12	13
Bridgeport, Conn.	†16.3	†17.3
Hartford, Conn.	†16.3	†17.3
Providence, R. I.	13	14

	Kerosine Yard	Kerosine TW	Mobilfuel Diesel TC	Mobilfuel Diesel TW	Mobilheat Fuel Yard	Mobilheat Fuel TW
New York:						
Manhat'n & Bronx	7.5	10.3	...	9.3	7.1	9
Kings & Queens	7.5	10.3	...	9.3	7.1	9
Richmond	7.5	10.3	...	...	7.1	8.8
Albany	7.5	9.8	7	9.3	7	9
Binghamton	8.9	11.2	...	10.7	8.4	10.2
Buffalo	8.6	10.9	8	10.3	8.2	10
Jamestown	8.7	11	...	10.6	8.3	10
Mt. Vernon	7.6	10.3	...	9.4	7.2	9
Plattsburg	8.1	10.4	...	9.9	7.6	9.4
Rochester	8.7	11	7.9	10.2	7.9	9.7
Syracuse	8.5	10.8	7.8	10.1	7.8	9.6
Conn.:						
Bridgeport	7.8	10.3	...	...	7.2	8.8
Danbury	8.2	10.8	...	...	7.5	8.8
Hartford	8.0	10.5	...	9.5	7.2	9
New Haven	7.8	10.3	...	9.3	7.3	8.9
Maine:						
Bangor	7.9	10.2	7.4	9.7	7.4	9.1
Portland	7.5	10.2	7	9.3	7	9
Mass.:						
Boston	7.8	10.6	6.9	9.2	7.1	9
N. H.:						
Concord	8.4	10.7	...	...	8.2	10
Lancaster	9.5	11.8	...	...	9.2	11
Manchester	8.5	11.1	...	...	7.9	9.7
R. I.:						
Providence	7.6	9.9	6.9	9.2	7.1	8.9
Vermont:						
Burlington	8.1	10.4	7.5	9.8	7.5	9.2
Rutland	8.3	10.6	...	10	7.7	9.5

*Does not include 1% city sales tax applicable to price of gasoline (ex tax).

†In steel barrels.

Discounts: Diesel—On t.w. deliveries, 0.5c for at least 400 gals.; 1c for full tank truck.

S. O. Indiana

Red Crown (*Regular Grade*)
Blue Crown (*Third Grade*)

Red Dealer Prices

	Crown Cons. T.W.	Red Crown	Blue Crown	Gasoline Taxes	Kerosine T.W.
Chicago, Ill.	11.6	9.6	9.1	5	
Decatur, Ill.	11.6	9.6	8.7	4.5	10.0
Joliet, Ill.	11.9	10.3	9.2	4.5	10.0
Peoria, Ill.	11.7	9.9	9.7	4.5	10.4
Indianapolis, Ind.	11.6	10.1	9.6	5.5	10.1
Evansville, Ind.	11.4	9.9	8.6	5.5	9.9
South Bend, Ind.	12	10.5	10	5.5	10.5
Detroit, Mich.	11.4	9.9	9.4	4.5	10
Grand Rapids, Mich.	11.4	9.9	9.4	4.5	9.9
Saginaw, Mich.	11.4	9.9	9.4	4.5	9.9
Green Bay, Wis.	12.2	10.7	10.2	5.5	10.9
Milwaukee, Wis.	12.1	10.6	10.1	5.5	10.8
La Crosse, Wis.	11.9	10.4	9.9	5.5	10.6
Minneapolis - St. Paul.	11.9	10.4	9.9	5.5	10.6
Duluth, Minn.	12.2	10.7	10.2	5.5	10.9
Mankato, Minn.	11.9	10.4	9.9	5.5	10.6
Des Moines, Ia.	11.4	9.9	9.4	4.5	*10.1
Mason City, Ia.	11.7	10.2	9.7	4.5	*10.4
St. Louis, Mo.	11.0	9.5	9.3	*4.5	10.1
Kansas City, Mo.	11.0	9.5	8.6	*4.5	9.7
St. Joseph, Mo.	11.2	9.7	9.2	*4.5	9.9
Fargo, N. D.	12.9	11.4	10.9	5.5	11.6
Huron, S. D.	12.3	10.8	10.3	5.5	11
Wichita, Kans.	10.3	8.8	7.2	4.5	8.7

Stanavo Aviation 73 Octane

Chicago, Ill.	15.7	4.5
Milwaukee, Wis.	15.9	5.5
Minneapolis, Minn.	15.7	5.5
St. Louis, Mo.	15.2	*4.5
Kansas City, Mo.	14.8	*4.5
Fargo, N. D.	16.7	5.5
Huron, S. D.	16.1	5.5

	Oleum Spirits	V.M.&P. Naphtha	Stanisol	*Taxes
(Prices are base prices before discounts)				
Chicago.	13.5	13.8	12.8	4.5
Detroit	15.8	15	16.3	4.5
K. C., Mo.	13.3	14.3	13.8	3.5
St. Louis, Mo.	13.7	14.7	13.2	3.5
Milwaukee	14.4	15.4	14.9	5.5
Minneap'ls	14.2	15.2	13.5	5.5

Fuel Oils T.W.
Chicago

	Standard Heater Oil
1-99 gals.	9.3
100-149 gals.	8.3
150 gals. & over	7.8

	Stanolex Fuel Oil No. 1	Stanolex Furnace Oil
1-99 gals.	8.8	8.8
100-149 gals.	7.8	7.8
150-399 gals.	7.8	7.8
400 gals. & over	7.3	7.3

	Stanolex Fuel Oil A	Stanolex Fuel Oil B
1-99 gals.	8.3	8.3
100-399 gals.	7.3	7.3
400-749 gals.	6.3	6.3
750 gals. & over	5.55	5.55

Stanolex Bunker C Fuel Oil

1-399 gals.	6.8
400-999 gals.	5.8
1000 gals. & over	4.8

Other Points Indianapolis	Stanolex Furnace Oil
1-99 gals.	9.0
100 gals. & over	8.0
Detroit	
1-99 gals.	8.7
100 gals. & over	7.7
Milwaukee	
1-99 gals.	9.0
100 gals. & over	8.0
Minneapolis	
1-99 gals.	9.1
100 gals. & over	8.1
St. Louis	
1-99 gals.	8.1
100 gals. & over	7.1
Kansas City	
1-99 gals.	8.1
100 gals. & over	7.1

***Taxes:** In gasoline tax column are included these city taxes—Kansas City, St. Joseph and St. Louis, 1c. Iowa kerosine prices are ex 3c state tax. In naphtha tax column are included 1.5c federal tax and state taxes.

State sales, occupation, consumer and use taxes to be added when applicable.

S. O. Nebraska

	(*Regular Grade*) T.W.	Dealer	Gasoline Taxes	Kerosine T.W.
Omaha	11.4	8.9	6.5	10.1
McCook	12.0	9.4	6.5	10.5
Norfolk	11.9	10.4	6.5	10.6
North Platte	12.3	9.9	6.5	11
Scottsbluff	12.9	9.5	6.5	10.5

S. O. Louisiana

Esso Gasoline (*Regular Grade*)

	Consumer Tank Wagon	Dealer T.W.	Gasoline Taxes	Kerosine T.W.
New Orleans, La.	8.75	9.25	8.5	*9
Baton Rouge, La.	8.75	9.25	8.5	*9.5
Alexandria, La.	8.75	9.25	8.5	*9.5
Lafayette, La.	9	9.5	8.5	*9
Lake Charles, La.	9	9.5	8.5	*11
Shreveport, La.	8.5	9	8.5	*8
Knoxville, Tenn.	9.5	10	8.5	12.5
Memphis, Tenn.	8.90	9.40	8.5	10.5
Chattanooga, Tenn.	10.5	11	8.5	11
Nashville, Tenn.	10.5	11	8.5	10
Bristol, Tenn.	10.95	11.45	8.5	13.1
Little Rock, Ark.	9.5	10	8	10

*Louisiana kerosine prices are ex 1c state tax.
Discounts:
Esso Gasoline—To undivided dealers, 0.5c off dealer t.w.

Humble Oil & Refining Co.

Humble Motor Fuel (*Regular Grade*)
Thriftane (*Third Grade*)

	Humble *Tank Wagon	Humble Retail	Thriftane *Tank Wagon	Thriftane Retail	Gasoline Taxes
Dallas, Tex.	7.5	10.5	6.5	8.5	5.5
Ft. Worth, Tex.	7.5	10.5	6.5	8.5	5.5
Houston, Tex.	8.5	12.5	7.5	10.5	5.5
San Ant., Tex.	8.5	12.5	7.5	10.5	5.5

	Kerosine *Tank Wagon	Kerosine Retail
Dallas, Tex.	7	10
Ft. Worth, Tex.	7	11
Houston, Tex.	8	11
San Antonio, Tex.	7	10

73 Oct. Aviation Gasoline	Tank Car
FOB Baytown, Tex.	8.5

*To all classes of dealers & consumers.

The Texas Co.

	Gasoline—Dealer T.W. Fire-Chief (*Regular*)	Indian (*3rd Grade*)	Gasoline Taxes
Dallas, Tex.	7.5	6.5	5.5
Ft. Worth, Tex.	7.5	6.5	5.5
Wichita Falls, Tex	8.5	7.5	5.5
Amarillo, Tex.	8.5	7.5	5.5
Tyler, Tex.	8.5	7.5	5.5
El Paso, Tex.	11	10.5	5.5
San Angelo, Tex.	8.5	7.5	5.5
Waco, Tex.	8.5*	7*	5.5
Austin, Tex.	8.5	7.5	5.5
Houston, Tex.	8.5	7.5	5.5
San Antonio, Tex.	8.5	7.5	5.5
Port Arthur, Tex.	8.5	7.5	5.5

*Less 1c temporary allowance to all dealers.

Continental Oil Co.

(N.B. Prices are Continental's "structural" prices. Prices do not reflect temporary reductions made to meet local competition.)

	Conoco Bronz-z-z (*Regular*) †Tank Wagon	Demand (*3rd Grade*)	Gasoline Taxes	Kerosine T.W.
Denver, Col.	11	10	5.5	11
Grand Junc., Col.	12	11	5.5	12
Pueblo, Col.	10.5	9.5	5.5	10.5
Casper, Wyo.	11.5	10.5	5.5	12
Cheyenne, Wyo.	11	10	5.5	11.5
Billings, Mont.	12.5	11.5	6.5	12.5
Butte, Mont.	13.5	12.5	6.5	13.5
Great Falls, Mont.	12.5	11.5	6.5	12.5
Helena, Mont.	13	12	6.5	13
Salt Lake City, Utah	13.5	12.5	5.5	14.5
Boise, Ida.	14.1	13.1	6.5	16.5
Twin Falls, Ida.	15.6	14.6	6.5	17
Albuquerque, N. M.	10	9	*7	9.5
Roswell, N. M.	9.5	8.5	*7	9

Continental Oil Co. (Cont'd)

	Conoco Bronz-z-z (*Regular*) †Tank	Demand (*3rd Grade*) Wagon	Gasoline Taxes	Kerosine T.W.
Santa Fe, N. M.	10.5	9.5	*7.5	10
Ft. Smith, Ark.	9.5	9.25	*7	9.5
Texarkana, Ark.	9	8	*5.5	9
Muskogee, Okla.	9.5	8.5	7	8.5
Oklahoma City, Okla.	9.5	8.5	7	8.5
Tulsa, Okla.	9.5	8.5	7	8.5

*Taxes: In gasoline tax column are included these city taxes—Albuquerque, & Roswell, 0.5c; Santa Fe, 1c. Texas 4c state tax applies within city limits of Texarkana, Ark.; Okla. 5.5c state applies within city limits of Ft. Smith, Ark.
†To consumers & dealers.

S. O. California

Standard Gasoline (*Regular Grade*)
Flight Gasoline (*Third Grade*)

	Standard Posted Net Tank Truck	Standard Posted Retail	Flight Posted Net Tank Truck	Flight Posted Retail	Gasoline Taxes
San Francisco, Cal.	10	14	9	12	4.5
Los Angeles, Cal.	9.5	13.5	8.5	11.5	4.5
Fresno, Cal.	11	15	10	13	4.5
Phoenix, Ariz.	12	16	10	13	6.5
Reno, Nev.	12	16	11	14	5.5
Portland, Ore.	10.5	14.5	9.5	12.5	6.5
Seattle, Wash.	10.5	14.5	9.5	12.5	6.5
Spokane, Wash.	12.5	16.5	11.5	14.5	6.5
Tacoma, Wash.	10.5	14.5	9.5	12.5	6.5

Std. Aviation 73

	Posted Net Tank Truck	Gasoline Taxes	Kerosine Tank Truck
San Francisco, Cal.	12.5	4.5	11.5
Los Angeles, Cal.	12	4.5	10
Fresno, Cal.	13.5	4.5	12.5
Phoenix, Ariz.	14.5	6.5	12.5
Reno, Nev.	14.5	5.5	13.5
Portland, Ore.	13	6.5	13.8
Seattle, Wash.	13	6.5	13.8
Spokane, Wash.	16	6.5	16.8
Tacoma, Wash.	13	6.5	13.8

Resale & Commercial: T.C. deliveries 0.25c per gal. off posted net tank truck.
Commercial: Retail deliveries, and/or tank truck deliveries of less than 40 gals., 4c per gal. above posted net tank truck price for Standard Aviation and Standard Gasoline, and 3c per gal. above posted net tank truck for Flight Gasoline, except single deliveries of less than 40 gals. to Marine trade only, which are billed at posted net tank truck price.

Canada

PRICES OF IMPERIAL OIL, LTD.

Per Imperial Gallon, which is 1.2 U. S. Gallons
3-Star Imperial Gasoline (*Regular Grade*)

	†Gasoline T.W.	*Gasoline Taxes	†Kerosine T.W.
Hamilton, Ont.	17.5	11	18
Toronto, Ont.	17.5	11	18
Brandon, Man.	21	10	23
Winnipeg, Man.	20.5	10	22.5
Regina, Sask.	18	10	20
Saskatoon, Sask.	20.8	10	22.8
Edmonton, Alta.	18.9	10	20.9
Calgary, Alta.	16	10	18
Vancouver, B. C.	15	10	24
Montreal, Que.	17	11	17.5
St. John, N. B.	16.5	13	19
Halifax, N. S.	16.5	13	19

*Includes 3c Federal, and Provincial taxes.
†To divided & undivided dealers.

Notice

These prices include inspection fees on both gasoline and kerosine unless otherwise specified per gallon as follows:

Alabama 1/40c on gasoline, 1/2c on kerosine; Arkansas 1/20c; Florida 1/8c; Illinois 3/100c; Indiana 1/5c in lots of 25 bbls. or less, 2/25c in lots of more than 25 bbls.; Kansas 1/50c; Louisiana 1/32c; Minnesota 7/200c; Missouri 1/50c; Nebraska 3/100c; Nevada, gasoline 1/20c; North Carolina 1/4c; North Dakota 1/20c; Oklahoma 2/25c; South Carolina 1/8c; South Dakota 1/20c; Tennessee 2/5c; and Wisconsin 3/100c.

Kerosine inspection fees only: Iowa 3/50c; Michigan 1/5c per gal.

WAR-OIL EQUIPMENT EXCHANGE

If You Can't Use It, Sell It or Scrap It!

For Sale

FOR SALE: 1943—4200 gal. Bradley semi-trailer with 1941 W A-18 White tractor, both in excellent condition, 85% rubber. B & T. Transit Co., Box 157, Smithfield, N. C.

Position Wanted

Man, thoroughly familiar with marketing Batteries, Tires and Accessories through Service Stations, capable of initiating and sustaining a complete program, seeks to join an Oil Company whose post war plans include the addition of these items.

Reply—Box No. 291
National Petroleum News

Situations Open

Automotive Engineer—College graduate with experience in lubrication, for technical sales and development work. Please include full details. Reply Box No. 290.

WANTED
INDUSTRIAL ENGINEER

Engineering graduate with practical refinery experience. Knowledge of planning and scheduling maintenance work, knowledge of refinery materials, some experience in time study and job analysis. Location Middle West.

Reply Box No. 293

WANTED
REFINERY METAL INSPECTOR

With practical operating and mechanical experience as well as sufficient engineering training to handle cracking plant and general equipment inspection. Medium size refinery and new Aviation Gasoline Plant. Location Middle West.

Reply Box No. 295

MANUFACTURING CHEMIST

Interested in obtaining man with practical experience in Testing of Petroleum Lubricating Oils, Manufacturing and Testing of Petroleum Greases. Will be in complete charge of all Manufacturing and Testing for Company. Opportunity to become financially interested in well established firm. Experience and references required.

PHOENIX OIL COMPANY
W. L. McCrary, Jr., President. Augusta, Georgia

Professional Services

ACCURATE LABORATORY TESTS
GASOLINE OIL
Standard Methods Employed
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554 Bagley Avenue, Detroit 26, Mich.

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The Gray Industrial Laboratories
Chemists and Engineers
Specialists on Petroleum Products
961-976 Frelinghuysen Ave.,
NEWARK, N. J.
Telephone Bigelow 3-4020

Wanted to Buy

WANT TO BUY: 5000 gallon 3 compartment tandem semi-trailer. Fruehauf or Butler preferred. On reply please quote cash price. A. J. Weigand, Dover, Ohio.

WANTED TO BUY—Air Compressors—service station sizes. Send full particulars to R. B. Richardson, 4720 Joy Road, Detroit 4, Mich.

Want a used meter, hose reel and pump, 1¼" to 2"; or we will buy items separately. State make and serial number. In reply quote price. Box No. 292.

Wanted to Buy—Service Station equipment 5000 gal. storage. Latest equipment only. Merritt Oil Company, R. F. D. No. 7, Winston-Salem, N. C.

WANTED two 9000 and one 4000 gal. horizontal tanks. Will sell two 15000 and one 12000 gal. vertical tanks.

Brindley Oil Co.,
1054 Payne Ave., St. Paul 1, Minn.

WANTED TO BUY

Late model approximately 2000 gallon semi. Advise make, price, sizes of compartments, tires, lines. Meter or pump equipped. Tank dimensions, mileage, etc. Photo or blueprint. Airmail, wire or phone—

Hood Oil Company
Tucson, Ariz.

WANT TO BUY

Complete Bulk Storage Plants from 20,000 gallon capacity to 200,000 gallon capacity.

Please describe Tanks, Pumps, Racks and Trucks.

R. C. STANHOPE, INC.,
60 East 42nd St., New York, N. Y.

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ABOUT OIL PEOPLE

Ralph W. Gallagher, president of the Standard Oil Co. of New Jersey is one of 46 industrialists who have been nominated for membership in the Chamber of Commerce of the State of New York. Election is scheduled for the fall meeting Oct. 7.

° ° °

J. G. Jordan, best known to the Mid-West as "Doc" Jordan, writes from his new job with the Shell Oil Co. at San Francisco about how well he likes California. "Doc" finds that the office copy of NPN isn't enough, so he is subscribing on his own account. "Doc" spent 11 years in Ohio, in charge of all of Shell's operations. He resided in Cleveland.

° ° °

C. H. Kunze, general manager of the marine transportation department of Socony-Vacuum Oil Co., announces the appointment of **F. E. Hansen** as assistant superintendent engineer. Mr. Hansen will assist the superintendent engineer, **S. Coates,** in supervising all hull, engine and machinery repairs on the company's deep sea vessels. Before joining the company in 1921, Mr. Hansen was in the U.S. Navy for 12 years with ratings ranging from machinist's mate to lieutenant, senior grade. For the past 8 years he has been port engineer in charge of engineering personnel on Socony-Vacuum's deep sea vessels.

° ° °

H. F. Means, sales representative for Globe Oil & Refining Co., residing in Topeka, Kans., has been transferred to Council Bluffs, Ia. where he will have charge of the company's terminal in Council Bluffs. He will also act as sales representative in territory surrounding Council Bluffs.

E. H. Walker has been appointed manager of the industrial relations-personnel department of Shell Oil Co. Mr. Walker started with Shell in 1932, following his graduation form Louisiana State University.

° ° °

A partnership of 5 years was dissolved when **J. W. Endres** purchased the interest of his partner, **J. D. Stuart,** in the Sterling Petroleum Co., Mt. Sterling, Ohio, recently.

° ° °

Ralph Park Russell, on leave from the Pennsylvania Railroad with which company he was superintendent of car service, has been appointed to succeed **Lee R. Cowles** as assistant director of PAW's transportation division.

° ° °

Tide Water Associated Oil Co. was host Sept. 22 to 75 officers and trustees of the National Petroleum Assn. at a luncheon in the Waldorf-Astoria hotel, New York City.

B. I. Graves, vice-president and director of Tide Water, acted as host and toastmastter. After the luncheon he introduced **Ray Vir Den,** vice-president of Lennen & Mitchell, Inc. Others who spoke were **H. T. Ashton** of Socony-Vacuum, and **J. W. Carnes,** president of Sinclair. **Lt. Robert B. Barnes,** U. S. N., formerly supply officer of the cruiser "Northampton" that was sunk off Guadalcanal, related his adventures in the South Pacific.

Other speakers included **Fayette B. Dow,** Washington counsel for NPA, and **Harry A. Logan,** NPA president. Guests included **Dr. J. E. Pogue, Dr. Gustav Egloff** of Universal Oil Products Co.; **Dr. Alfred P. Haake, H. W. Dodge,** director of PAW District 1; **C. E. Arnott** and **Walter Faust** of Socony-Vacuum; **C. L. Harding, R. G. A. Van der Woude** of Shell, and **W. V. Hartman** of Gulf.

W. H. Linton has been transferred from Sun Oil Co.'s Marcus Hook refinery to Philadelphia where he is in charge of accounting activities connected with the manufacturing department and refinery operations.

° ° °

The Merchant Marine Distinguished Service Medal "for heroism and meritorious service beyond the line of duty" has been awarded **William F. Dalton,** chief engineer of a Sun Oil Co. tanker, torpedoed some months ago in the Atlantic. Colorful ceremonies were held at the Todd Erie Basin in New York and presentation of the medal was made by President Franklin D. Roosevelt's representative, **Capt. Richard E. Pendleton,** district marine superintendent.

According to the citation, the torpedo caused an explosion which blew through the after deck, igniting the tanker's cargo of oil and enveloping that part of the ship in flames. Mr. Dalton took charge of the burning tanker and brought the fire under control. The crew subsequently brought the tanker to port. It has since been repaired and returned to service.

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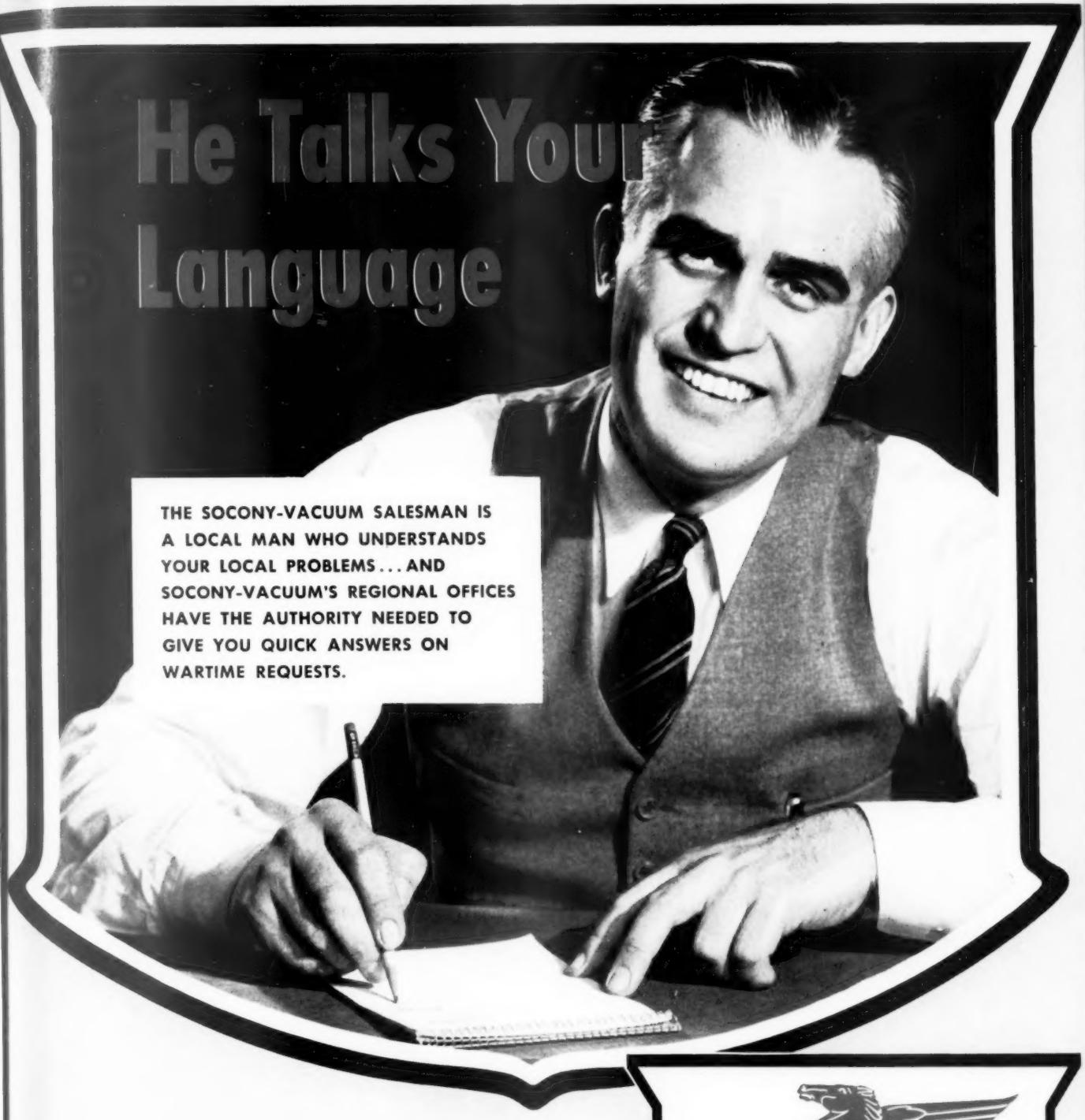
Neal Shanahan, Bodie-Hoover Petroleum Corp., Chicago, recently changed his NPN mailing address to "Uncle Sam's Fighting Forces, wherever-they-send-me".

° ° °

David W. Bussell, Texarkana, Tex., oil transportation specialist, is now a Navy ensign, stationed at the Naval Station, New Orleans.

These men were among the speakers when Tide Water Associated Oil Co. played host Sept. 22 to officers and trustees of the National Petroleum Assn. in New York City's Waldorf-Astoria hotel. Left to right are Harry A. Logan, President, National Petroleum Assn.; B. I. Graves, vice-president, Tide Water; Lieut. R. P. Barnes, U. S. Navy; Fayette B. Dow, Washington Counsel, N.P.A.; C. E. Arnott, vice-president, Socony-Vacuum Oil Co.

He Talks Your Language



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• Thirty-five months of the hardest type of service station delivery service—jolting stops and starts, chuckhole pavements, racking turns in confined spaces—but not a single tie-up for repairs of any nature for Phillips Petroleum Company unit shown above.

These figures show that a properly designed semi-trailer should be expected to stand up day in and day out under the most punishing work.

The Sinclair Refining Company unit piled up 80,686 miles in a nine-month period of war emergency operation which freed desperately needed tank cars for Eastern service.

TRUCK TANKS
TRANSPORT TRAILER TANKS

Standard Steel Works
NORTH KANSAS CITY, MO., U.S.A.

TECHNOLOGY DEPT.

NATIONAL PETROLEUM NEWS

Monthly Technical Section Devoted to

REFINERY MANAGEMENT *and* PETROLEUM CHEMICAL TECHNOLOGY

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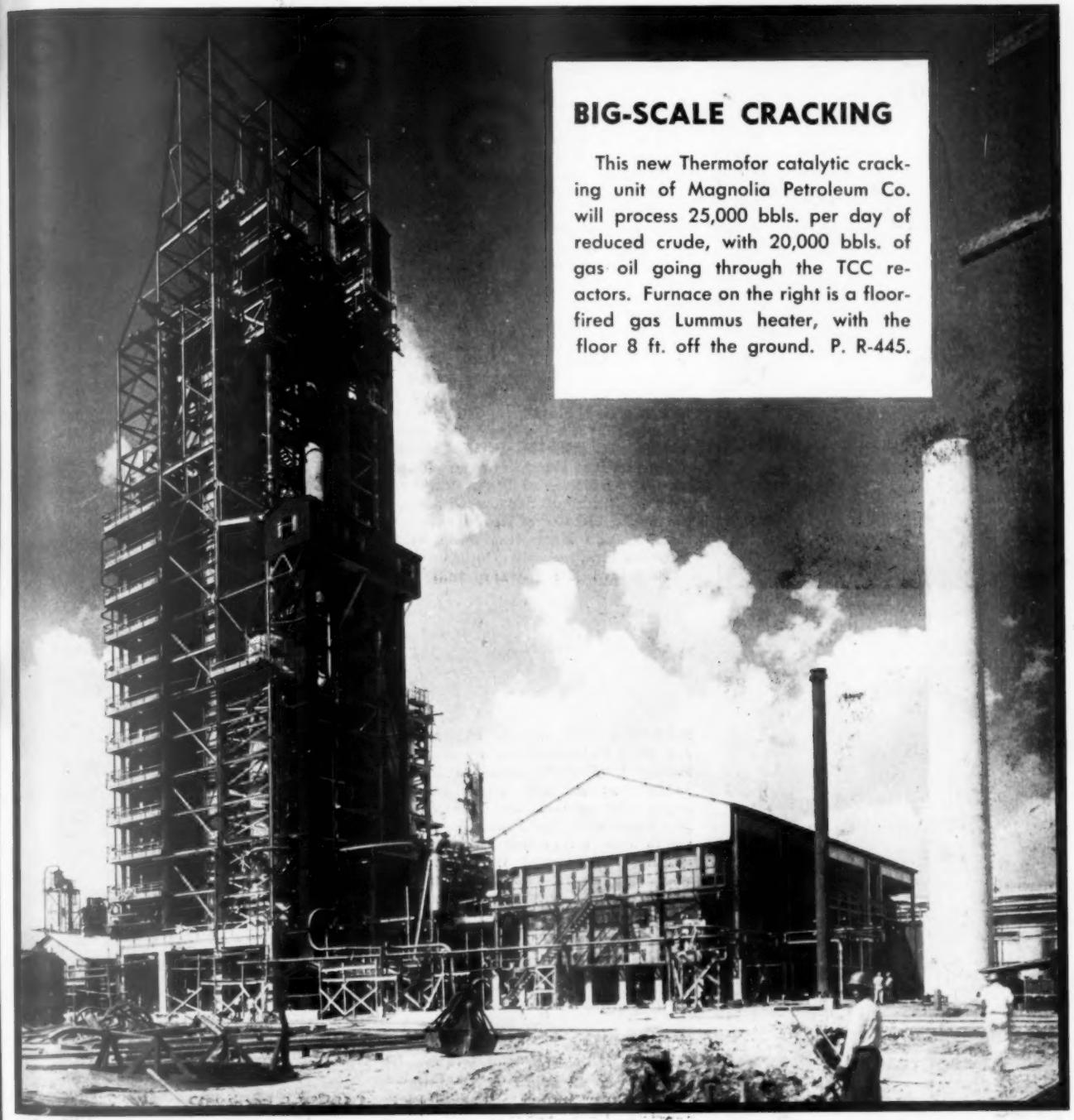
Section Two **October 6, 1943**



BIG-SCALE CRACKING

This new Thermofor catalytic cracking unit of Magnolia Petroleum Co. will process 25,000 bbls. per day of reduced crude, with 20,000 bbls. of gas oil going through the TCC reactors. Furnace on the right is a floor-fired gas Lummus heater, with the floor 8 ft. off the ground. P. R-445.

How sour crudes are now being processed by conventional methods into a full line of products, including lubricating oils, is told from the experience of these refiners for the benefit of operators who will be called on to run sulfur crudes in coming months. Equipment requirements are somewhat different and the importance of careful, methodical inspection of equipment is emphasized, this to be continued for some months . . . pg. R-443.

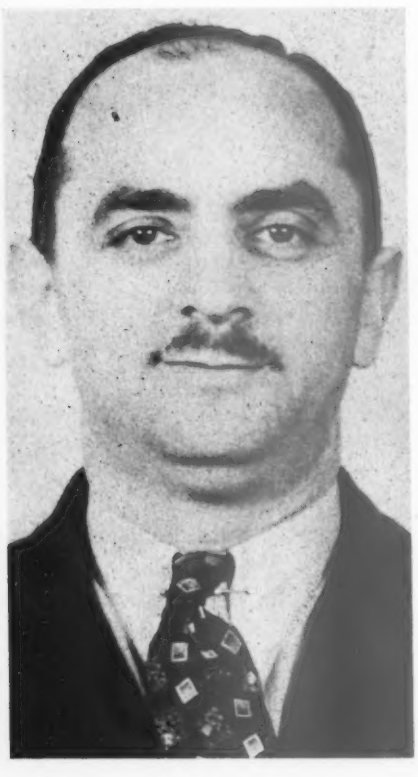
In the design of foundations for towers, absorbers and other refinery vessels it is important that consideration be given to atmospheric, climatic and soil conditions, because of the increasing height to which this equipment is being constructed. Methods for the inclusion of these factors in the design of various types of horizontal and vertical vessels are presented and the design formula given. By J. S. Shjarback . . . . pg. R-459.

Technical Advisors in the Wartime Refining Program

STUDY of processes for making new products or new methods for improving present products: Study of new proposed methods for analysis for plant control purposes of the hydrocarbons newly used as raw materials in processing wartime products: Correlation of reports on research work received from many oil companies participating in various projects: These are important functions of the Technical Advisory Committee of the Petroleum Industry War Council which are directed by four subcommittees. Their chairmen are:

H. W. FIELD, left, chairman of TAC Subcommittee on Synthesis, is assistant manager, Research and Development Department, Atlantic Refining Co., Philadelphia. A graduate in chemical engineering from University of Pennsylvania, he started with Atlantic in 1928, holding various positions in the laboratory and research and plant development department. In the war program he also participates in the development work on aromatic compounds and toluene plant conversion

P. J. HARRINGTON, right, is chairman of the TAC Subcommittee on Primary Processes, formerly the Butadiene Subcommittee. He is also a member of TAC's Executive Board. He received his M. S. in Chemical Engineering Practice from Massachusetts Institute of Technology; was in the Technical Service Division of Standard Oil Co. of New Jersey from 1929-36 and since has been in the Process Engineering Department of Standard Oil Development Co.



HARRY LEVIN, left, is chairman of the TAC Subcommittee on Analysis. Except for 2 years spent in the laboratory of an edible oil concern, since his professional training he has been with The Texas Co., where he is now supervisor in charge of the analytical and testing service at its Beacon, N. Y., research laboratory. He has degrees in chemistry and law and specialized in analytical chemistry

W. E. CHALFANT, right, is chairman of the TAC Correlation Group. He has been with Atlantic Refining Co. since graduating in chemical engineering from Pennsylvania State College in 1935. He is now in charge of all Atlantic's light oil pilot plant work. In the war program he has been active in the development of processes for the manufacture of cumene and ethyl benzene

REFINERY MANAGEMENT *and* PETROLEUM CHEMICAL TECHNOLOGY

Oct. 6, 1943
Volume 35
Number 40

A MONTHLY TECHNICAL SECTION OF NATIONAL PETROLEUM NEWS *incorporating International Petroleum Technology*

Full Line of Products from High Sulfur Crudes by Conventional Processing

PROBLEMS attendant upon the refining of sour crudes in manufacturing products competitive with those from sweet crudes have been solved by several refiners. The products marketed by these companies include gasoline, kerosine, gas oils, fuel oils, tractor fuels, residual fuel oil and lubricating oils, as well as certain specialty products, aviation gasoline, and other war products.

Technologists and operators say there is little fundamental difference in refining sweet and sour crudes—the latter being defined as a crude containing or evolving H_2S during processing. However, equipment requirements are slightly different, in that they must withstand corrosion from the hydrogen sulfide, naturally occurring or evolved; protect the operators from the poisonous effects of hydrogen sulfide, and avoid fires resulting from spontaneous oxidation of iron sulfide.

Precautionary Measures

To permit equipment to withstand corrosion, 2 steps are necessary: Desalt the crude to reduce chloride corrosion and use chrome alloy steel when temperatures are in excess of 600° F. This may be modified to a certain extent by "concentrating" the corrosion in certain pieces of equipment which are relatively inexpensive and suitably located for convenient and frequent replacement. Such equipment might include heat-exchangers made of carbon steel or cast iron, or the installation of alloy clad flash chambers with provision for eliminating much of the hydrogen sulfide sure to be evolved in processing. Use of alloy metals around feed inlet on fractionator columns (a frequent trouble zone) will greatly reduce replacement expense. Of course trays and caps should be suitably protected also. Injection of lime in the crude prior to cracking or use of ammonia or caustic ahead of light products condensers may be of help, depending on the individual case.

Even with all these measures, however, there are sure to be some losses from corrosion unless all equipment subject to corrosion is protected with alloy steel. This is out of the question even in ordinary times because of the expense involved; chrome alloys are difficult to obtain in wartime.

To protect personnel from hydrogen sulfide gas, vapor recovery systems have been installed, having the additional purpose of more economical operation by permitting utilization of the volatile products thus recovered. If a tank or other vessel is to be opened for inspection or repair, it should be degassed before men are permitted to enter. If this is impractical for some reason, air masks may be employed.

The only satisfactory way of preventing spontaneous combustion of iron sulfide is to keep oxygen (air) away from it. Places where FeS is likely to be found are desirably kept wet with water until it can be removed to a place where oxidation will do no damage, or it may be buried. Safest procedure is to allow it to oxidize where it can do no damage.

For the dual purposes of personnel safety and protection to equipment, it is essential that all equipment be carefully inspected, especially the known danger points, *every time* the plant comes down for cleanout, each 60-90 days. Nor is this inspection a cursory one; it is a searching, minute examination of equipment, pumps and lines. Vessels are drilled and calipered; towers entered and checked for pitting and other conditions; condensers thoroughly checked, shells hammered and so on. Even then, in spite of all precautions, corrosion will crop up in unexpected places and cause trouble when it is least convenient.

Inspection Must Be Thorough

A careful inspection always is indicated when a change in crude composition is made or when there is a change in processing itself. This would include alterations in flow rates, operating temperatures and pressures. In processing a sour crude for the first time, a refiner is advised that careful inspections are doubly indicated, for it may be impossible to determine all corrosion danger points in advance. Moreover, the idiosyncracies of the individual unit cannot be accurately predicted. Inspections should continue on the exhaustive basis until 5 or 6 cleanouts have occurred, at least; for it may take a year or longer in many cases to "get on" to all the corrosion peculiarities. Because none are found on first or second inspection, both inspectors and operators may be lulled into a false sense of security.

Hot oil pumps, handling products at or in excess of 600° F., without regard to pressure, are often protected with 11-13% chrome steel. Any temperature gradient above this requires equipment protected with at least 2% chromium alloy. No brass trimmed valves or pipe fittings are permitted on product lines; they are likely either to freeze closed or plunger and seat may be eaten away if the valve is normally operated in open position. Of couse, brass fittings may be used on water lines, or lines in low temperature service.

Where, because of excessive expense of alloys, it is necessary to use carbon steel piping, it is desirable to specify double strength line. Inspection may reveal after about a year in service that corrosion has been uniform. Sometimes even with pitting or other localized corrosion the pipe can be crushed in the bare hand if corrosion has been severe.

Tanks Take Punishment

"The refinery may as well get ready to take a licking on tanks," stated one refinery manager, "as no sure-fire solution but a stainless steel tank will take the punishment furnished by H_2S-bearing crude." Metallizing has been attempted with varying degrees of success, it is reported. Guniting is not looked on with favor by some refiners, although others have recommended it.

Should it be found desirable by the individual refiner to use lime in cracking coils (not considered necessary by all if coils are of chrome alloy), experiment will have to indicate how much is required. Some technologists say 0.2 to 0.25 lbs. per bbl. crude is a common range. Something to remember, they caution, is to choose that grade which settles the least. (This can be determined readily by suspending several samples in light gas oil, using the one which settles least after thorough agitation.)

In one illustrative refinery, the crude is desalted electrically, using the Petreco process*. This substantially minimizes hydrogen chloride corrosion, to which some chrome alloys have no marked resistance. Also, it reduces the use of ammonia in heat exchangers and pre-

*"Desalting Refinery Crude Stocks," Technical Section, *National Petroleum News*, July 7, 1943, p. R-307.

cludes plugging of equipment through deposits of ammonium salts.

The raw crude is next stabilized in a pre-flash chamber, where approximately 3% of the casinghead and other light products are removed at a temperature not exceeding 250° F. Vapors evolved during pre-flashing are passed to a vapor-recovery system where the light hydrocarbons are separated from hydrogen sulfide and other noncondensables. Light hydrocarbons go to the casinghead plant for use in blending gasoline, hydrogen sulfide being removed by caustic scrubbing, and non-condensables are used as fuel-gas.

The pre-flashed material, largely stripped of its hydrogen sulfide content although still high in total sulfur, and consisting of several different high sulfur crudes or mixture thereof, then goes to the topping still. This still, like the pre-flash unit, is constructed of ordinary carbon steel. Here, about 50% of the crude is topped off in a conventional topping operation, the overhead consisting of gasoline, kerosine, naphtha and Nos. 1 and 2 fuels; bottoms being charged to a vacuum still. The vacuum still bottoms, consisting of 25% of the original charge, are suitable for manufacturing road oils, residuum fuels, and asphalts.

Admiralty metal tubing with cast iron sections is used in gasoline condensers. Ammonia is injected ahead of the condensers in sufficient concentration (0.01-0.02 lbs. per bbl. charge) to keep pH of aqueous condensate in range of 7-7.5. Subsequent treatment of gasoline is by caustic wash and copper sweetening. Transfer and run-down lines are of ordinary carbon steel.

Heavy Gas Oil Cracked

Heavy gas oil from the topped crude constitutes charge stock for cracking. This material, which may have a small fraction with as low an initial point as 300° F. and an end point as high as 1000° F. is described as a 24° A.P.I. gas oil charging stock of light straw color. It is cracked to a conventional line of products, gasoline, distillate and fuel oils. Light gases and gasoline, which contain hydrogen sulfide freed by cracking temperatures, are charged to a conventional stabilizer. Here the light gases, some of which are unsaturates, go overhead; while the heavier volatiles are taken off the side, run to cracked gasoline storage after a caustic wash followed by sweetening. Light gases are freed of hydrogen sulfide and charged to a polymerization plant. Since no sulfur-bearing raw materials are charged, no anti-corrosion design is required.

The cracking unit is a liquid-phase thermal cracker, tubes and headers of which are 2% chromium, 0.5% molybdenum alloy steel. In the more than 3 years these tubes have been in place there is no evidence to date of corrosion. Outlet temperature in the last pass is held to about 960° F. Transfer line to the flash chamber is 4-6% chromium, 0.5% molybdenum; flash chamber, operated at 125 lbs. per sq. in. pressure and 800° F. temperature at the bottom, is lined for 2/3 of its vertical height with "18-8" stainless steel. The flash chamber is, in reality, a combination flash chamber and fractionator tower, the upper portion being supplied with stainless steel bubble caps, trays and risers at all points where the temperature gradient exceeds 600° F. Above this, the tower construction, as well as trays, is of carbon steel.

Condensers, of cast iron, may be protected from corrosion to some extent by use of weak caustic. The caustic will indicate the presence of corrosion upon examination by the presence of a black precipitate of FeS. Subsequent refining is substantially conventional.

Lubricating Oil Manufacture

Lubricants can be made entirely from high sulfur crude, having in excess of 3% S in addition to carrying considerable salt. Crude oil for lubricant manufacture is first pre-flashed and topped as in normal manufacture of lubricants from so-called sweet crude. A point strongly made is that there is NO fundamental difference between processing a lubricating stock from a sour crude and a stock from a sweet crude. There is no "sour" odor (any hydrogen sulfide, light polysulfides and mercaptans have long since been removed by topping), neither is the appearance particularly different from a "sweet" lube stock.

Another point made is that, while there are no special types of equipment necessary in lubricant manufacture, the sequence of steps and degree of refining may desirably be different from that employed with many low sulfur crudes. Careful studies need to be made of the results of acid treating or solvent extraction; each of which is amply capable of doing as much harm as good unless judiciously employed.

Although the truism that "over-refining" is poor refining is as universally recognized as any principle can be, operators with experience caution about over refining of high sulfur crudes by either solvent extraction or acid treating. Granting that some high sulfur stocks probably reap great benefit by this process step, solvent extraction is one of the most drastic means of reducing sulfur content of moderately high molecular weight hydrocarbon mixtures. The nature and utility of the sulfur components of lubricating stocks should be carefully considered. They may be highly effective as film strength agents or corrosion inhibitors. If they prove so, then the extent to which they are to be removed either by solvents—or the less potent reducer of sulfur, sulfuric acid—is a question which must be given profound study. Otherwise, the natural values of the raw material may not be fully utilized.

Practically identical consideration must be given to solvent and acid treating from the viewpoint of compositional balance in the finished lubricant. It has been well established that the most stable petroleum lubricating compositions contain open chain paraffinic aggregations, naphthenic rings and aromatic rings in relatively definite ratios. While a portion of the aromatics appear to be too unstable to tolerate under any conditions and many of the remainder are—in the pure state—less stable than pure compounds of the completely hydrogenated type, aromatics actually may add to the stability of the latter; so that a balanced mixture of all three types of compounds can be far more durable in service than would any one alone or any improperly balanced mixture.

To check on whether or not the finished oil represents these optimum ratios seems to be a somewhat laborious, cut and try affair. The only unreserved recommendation given by refiners with experience is that oils be prepared by treatments of varying severity and the products tested in engines under controlled conditions; thereafter comparing the results.

As to what "a lubricating oil should be:" technologists consider that an oil must meet 4 criteria to be satisfactory. It must not permit excessive wear (either true or slow wear from lack of "oiliness;" or rapid wear, scoring, due to insufficient film strength). It must be non-corrosive to bearing metals. It must not permit deposits causing ring-sticking or other deposits of importance in an engine. It must have a reasonable service life. Most any lubricant worthy of the name has 2 or 3 of these criteria: Adding the 3rd is more difficult, and the real trick is to simultaneously achieve all four.

* * *

TULSA—The pipeline companies and producers in the Mid-Continent are not agreed on the sulfur and other impurities characteristics of the West Texas crudes which will be in coming months widely shipped to refiners, replacing in part the sweet crudes they have been using. The properties of the sour crudes they will be supplied will depend largely on whether or not output from various fields is "batched", desalted and perhaps even partially or completely desulfurized. Authorities state there is no known satisfactory method for de-sulfurization, prior to processing. However there have been reports for some time that such a process is in the making.

Crude produced in the McCamey area in Upton county, Texas, contains around 3% total sulfur maximum; that of Eddy county, N. M., less than 1%; that from Hockley county, Texas, about 2.5% maximum. However, several recent deep discovery wells in West Texas areas are reported to be showing crudes lower in sulfur content, despite the fact they have been drilled through shallower areas now producing high sulfur crude. Should all these streams of oil be heterogeneously intermingled, the resultant sulfur content may range from 1.5 to 2.5%.

Two Improvements in the TCC Process Help Its Yield of Aviation Gasoline

721.33

TWO important improvements in the Thermofor catalytic cracking process since the start of the war have aided in the conversion of this process, originally developed to produce motor gasolines, to produce good yields of high quality aviation gasolines and materials for synthetic rubber.

One improvement is the use of a solid catalyst bed reactor, in place of the angle type reactor. By this change the space velocity of the reaction has been cut down to one sixth, which has improved the quality of the products in retreating. In the earlier installations the reaction zone contains iron baffles designed to provide intimate contact between the oil vapors and the catalyst. The use of the solid bed of catalyst does not change the circulation of the catalyst, which, by an arrangement of conveyors, moves continuously through the reactor and the regenerator. The regenerator in most cases is a spiral-finned type of Thermofor kiln, which was developed by engineers of the research and development division of Socony-Vacuum Oil Co., Inc. The main burning zone of the kiln is filled with a bundle of spiral-finned tubes which provide air passages up under the fins, while the catalyst moves slowly downward over and around the fins. Molten salts or other heat-transfer mediums are circulated through the finned tubes to control the temperature of regeneration.

Bead Catalyst Efficient

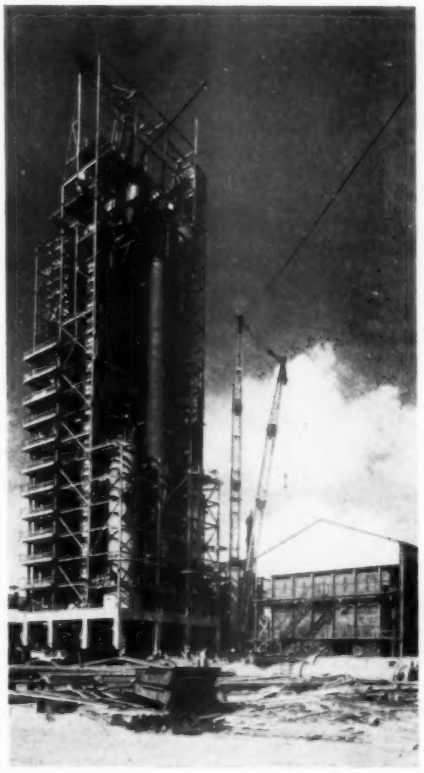
Second improvement in the TCC process is the use of the new synthetic bead catalyst announced last spring by Socony-Vacuum Oil Co., Inc. The catalyst is in the form of translucent spherical particles resembling small glass beads in appearance, the beads averaging about 1/7 in. in diameter. An individual TCC bead will carry an average load of about 200 lbs. before crushing, it is claimed, and a mass of the beads packed in a column will carry a load equivalent to about 3000 lbs. per sq. in. without breaking. A life of 2 years or more in service is predicted for the bead catalyst.

The improved yields of aviation gasoline base stocks obtained from the synthetic bead catalyst are shown as follows for 3 types of charging stocks, as compared with yields obtained from clay catalysts taken as 100%: Paraffinic stock, 130%; naphthenic, 125%; mixed base charging stock, 113%. Catalysts previously used have been largely silica-alumina compositions, made by synthesis or by the chemical treating of natural clays.

Motor gasoline is produced by the TCC process by cracking distillate stocks, either once-through or with recycling. Motor gasoline yields of 35 to 45% single-pass and of 50 to 60% with recycling are said to be representative of commercial operations. Recycling is preferable from the standpoint of ultimate yield, as the firt step in the production of aviation gasoline.

Aviation gasoline of high quality is produced by reprocessing the first-pass motor gasoline in a TCC reactor operated on a once-through basis, at somewhat lower throughput rates than in cracking but with substantially the same temperatures and pressures as in motor gasoline operations. The second-pass operation which yields 80 to 95% of the aviation cut present in the motor-gasoline charge serves primarily to improve the leaded octane numbers, oxidation stability, gum stability, and aromatic content of the aviation fraction.

Advantages of the TCC process in addition to its yields of aviation gasoline materials and by-products, including heating oils, aromatics and propylene, are said to be relatively low construction costs, low requirements for alloy steels and the conversion of excess heat obtained in the catalyst regeneration into high pressure steam. It is also adaptable to existing refinery equipment.



Large size Thermofor Catalytic Cracking unit at a Magnolia Petroleum Co. refinery, in advanced stage of construction. (Cover illustration is of the same unit completed.)

Following the wartime demand for aviation gasoline, it is said the process will find wide application for the manufacture of catalytic motor gasoline, in that it will provide high quality base materials and also the butane-butylene fractions for blending purposes if desired.

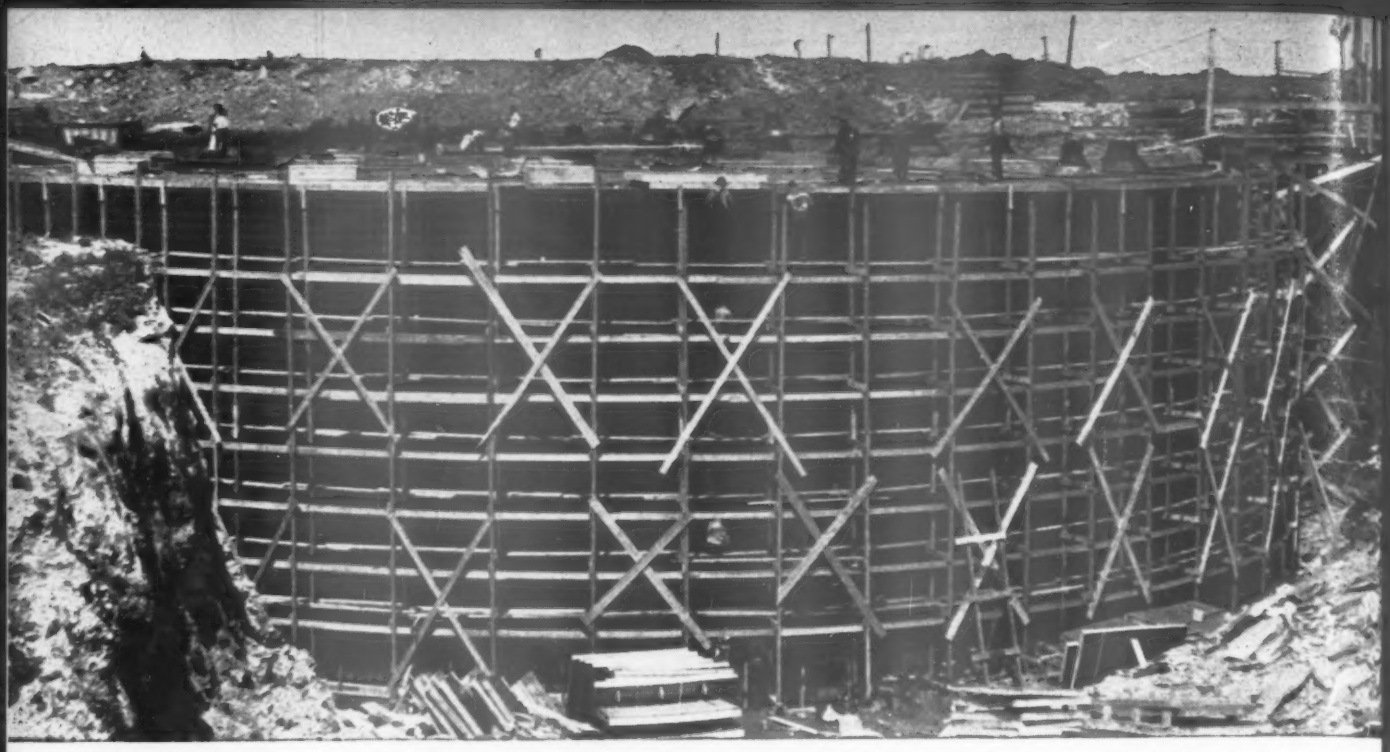
Many Being Built

A considerable number of Thermofor catalytic cracking process reactors and regenerator units are under construction now, and the engineering work on two additional units has been completed. Some of the units under construction are conversion jobs in which thermal equipment is being used for distillation units and heaters. Conversion units are being built for Gulf Oil Corp., Pure Oil Co., Sinclair Refining Co., and Tide Water Associated Oil Co. New units are under construction for Magnolia Petroleum Co., Continental Oil Co., Crown Central Petroleum Corp., General Petroleum Corp., Ashland Oil & Refining Co., Socony-Vacuum Oil Co., Inc. (Lubrite Division), Union Oil Co. of California, Richfield Oil Corp., Socony-Vacuum Oil Co., Inc., Standard Oil Co. of California. Engineering for the TCC units is being done by the Lummus Co., New York, refinery engineers.

Magnolia's Unit Described

The large size Thermofor Catalytic Cracking unit at a Magnolia Petroleum Co. refinery, shown in the accompanying illustration, is designed to process 25,000 b/d of reduced crude, with 20,000 bbls. of gas oil going through the TCC reactors.

The furnace shown at the right is a floor-fired Lummus heater with the floor 8 ft. off the ground so that the operator can walk underneath the furnace and regulate the gas burners conveniently. The furnace has 2 heating circuits, one for vaporizing the gas oil from reduced crude, leaving a tar bottom, and the other for superheating the gas oil vapors which go to the reactors. The unit has a service elevator for conveying maintenance materials and operators or maintenance crew from the ground level to different points to the top of the structure.



Construction of a large underground concrete oil storage tank by the pre-stressed method. Tension is applied to the steel reinforcing rods to hold the concrete under compression.

Tanks of this type, lined with a polysulfide plastic of the synthetic rubber family, are used by the Navy for aviation gasoline storage.

Concrete Tanks Leak-Proofed for Gasoline Storage with Synthetic Rubber Latex

645
778.3

Applying a polysulfide plastic in latex form as lining for sides and floor of concrete tank for aviation gasoline storage. Primer coats are first put on by brush, followed by a layer of cotton fabric, after which finish coats of latex are applied

Synthetic rubber linings for concrete tanks for the storage of high-octane gasoline, a wartime development to conserve steel, have been perfected to the point where they are being used by the Navy in large underground tanks for the storage of aviation gasoline. The tanks on which the linings are used are built by the pre-stressed method, which holds expansion and contraction of the concrete to a minimum and thus prevents cracking in the walls. "These methods have worked so successfully that high-octane gasoline can and now is being stored in concrete underground tanks," states an announcement from the Navy Department.

One type of lining being used is sheet thiokol, cemented to the interior of the tank, which has already been described.* Another type consists first of thiokol in latex form painted on the tank interior. Then a layer of cotton fabric is imbedded on the latex and subsequently thiokol is applied over the fabric. Since less skilled labor is needed in applying this latter type of lining and since no fire or explosion hazard exists, it is said that this type has been designated for tanks where skilled labor is not readily available.

Description Is Given

The following description of the thiokol latex form of lining is given by F. R. Stoner, Jr., president of Stoner-Mudge, Inc., Pittsburgh, which company did the development work with this lining:

"The problem of the latex system of lining started at scratch with no information available to serve as a guide in the choice of the proper starting materials and very inadequate equipment

*"Sheet Linings of Synthetic Rubber for Concrete Gasoline Tanks", Technical Section, National Petroleum News, May 5, 1943, pg. R-200.

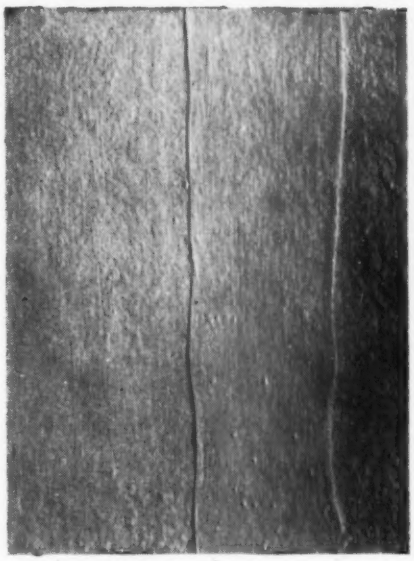
on hand to produce and further process the polysulfide latex. Work was started at once both in the company's own laboratories and in those of its research fellowship at the Mellon Institute of Industrial Research in Pittsburgh, to determine the basic type best suited and to develop the best means of application. Particular attention was given to the most ideal condition of the concrete to receive the lining and upon request the Bureau of Yards and Docks of the Navy Dept. made provision in the specifications to insure the recommended surface preparation.

"One large tank was coated experimentally and as a result of this experience the material itself was radically changed and it was determined that the most practical means of application was by calcimine brush. Up to this time the lining system had consisted of a number of coats of polysulfide latex compound without reinforcement. A logical step then was the introduction of a reinforcing fabric of sufficiently open weave to become thoroughly saturated with the latex and to lend tensile strength and toughness to the lining. This fabric does essentially the job for the latex, which is low in tensile strength, that fabric does for an automobile tire. Approval of the reinforced system was forthcoming without delay and a considerable number of the Navy tanks were scheduled for this type of lining.

6 Coats of Latex Applied

"The system used involves brush application of six coats of latex. The fabric is hung on the second prime coat much as wall paper is placed. A smooth damp surface is ideal for the application of latex and being applied as a liquid makes the system readily adaptable to any contour. The walls and floors are lined separately and the wall fabric is normally carried out over the floor for a distance of 12 in. to 18 in. In the larger tanks an extra thickness of cloth is applied to the ring joint and adjacent areas of wall and floor since one function of the lining is to prevent loss of contents due to leakage which might develop at this joint."

To apply the lining properly the concrete must be clean and free from grease or oil and particularly from dust, it is pointed out. If dustiness is in evidence the surface must be wire-brushed and the whole tank thoroughly flushed with water. The latex is applied while the concrete is damp. If the concrete surface is perfectly dry it is first dampened to slow down evaporation. The first primer coat is applied and allowed to dry to a rubbery state. The cotton fabric, previously dampened, is hung on the second coating of latex while it is wet and the third coat of latex is applied immediately on the damp cloth. Sufficient time is allowed for coalescence. The fourth coat of primer is followed by two finish coats, allowing each to coalesce



Interior of concrete tank wall after lining with latex in which cotton fabric is embedded. Finish coats of latex are put on by brush

before the next is applied. Efficient flashings can be applied by putting a coat of latex on the surface, setting the cloth into it and following with the requisite number of coats.

Method Is Flexible

This method of lining concrete tanks is said to be flexible for its utilization under different conditions. It is said to have been applied successfully under widely different climatic conditions, from the jungles to the winter belt in the U.S.

Another type of lining for concrete tanks being used by the Navy is a vinylite plastic, spray painted on the interior walls and floor. It is being used in tanks for diesel oil and gasoline storage.

In addition to using the pre-stressed method of construction, the method of placing the earth fill around the tank aids in balancing stresses and acts as an insulator to reduce temperature stresses.

The overcoming of the tendency of concrete to crack and allow the escape of oil held in storage has made it economically feasible to build concrete tanks underground, a special advantage for storage at military depots. The Navy, according to its announcement, is now building hundreds of concrete tanks for storage of gasoline and fuel oils. The concrete tanks are being built with 4 feet of earth cover over their tops upon which natural vegetation is planted.

This not only effectively conceals the tanks from enemy air observers but also renders them safe from incendiary bombs and shrapnel. A Navy announcement of its adoption of concrete tanks for oil storage states:

"Concrete usually has had two disadvantages which militated against its effective use for liquid storage. One was its disposition to develop cracks from changes in temperature and other causes. Through these cracks liquid could escape. The other was the porosity of the concrete itself, which permitted seepage.

"To counter the first of these disadvantages, the Navy adapted pre-stressed concrete to its use. To offset the second, the Navy, in cooperation with industry, developed various types of linings for the inside of the tanks which in effect form a big envelope containing the stored fuel and keeping it from seeping through the porous concrete.

Earth Fill Plays Part

"Engineers have known for decades that concrete could be pre-stressed, a method of drawing the concrete tighter by pressure so that expansion and contraction from temperature changes, and the accompanying tendency to develop cracks, would be held to a minimum. Steel rods around the concrete are tightened once the material is dry. The Navy, however, has developed a new process in which the earth fill around the underground tank is so engineered that it plays an important part in balancing the stresses.

"For storing heavy fuel oil, it was found that all that was necessary was to paint the inside of the concrete tank with waterglass. This, together with the wax in the fuel, sealed the pores.

"For diesel oils and gasoline, three different types of lining materials were developed. These methods have worked so successfully that high-octane gasoline can and now is being stored in concrete underground tanks.

Large Saving In Steel

"The steel rods used in pre-stressing the concrete are a decidedly less critical material than shapes and plates. Furthermore, the overall total of steel used in the concrete tanks is less than half the steel used in steel tanks. In some instances, particularly where the tanks are to be located a long distance from steel mills, the concrete tanks can be made at a great deal less cost than comparable steel tanks, and can be built more rapidly.

"Steel tanks of a prefabricated, demountable type are used at advance naval bases.

"Lieutenant Commander John L. Mason (CEC), U.S.N.R., as a consulting engineer of Modesto, Calif., designed the first pre-stressed concrete oil storage tanks constructed for the Navy. They were authorized in November, 1941. Construction of concrete storage tanks for gasoline was authorized early in 1942. The number of all types included in the program, is well in excess of 2000 tanks. They vary in size from those with a capacity of 25,000 gals. to those which will hold 2,520,000 gals."

Theory of Pre-Stressed Design Of Concrete Tanks is Described

*The largest concrete tanks ever built above ground, as far as is known, were constructed by a pre-stressed method designated as the "preload" method. These tanks are in use for fuel oil storage by a Canadian oil company. The two tanks, each of 100,000 bbls. capacity, are 132 ft. in diameter and 42 ft. high. Their dome roofs are of a special type of construction only 4 ins. thick.**

The Preload Co., construction engineers with headquarters in Boston, which built the tanks, also constructed some underground concrete tanks for the Navy, intended for gasoline storage after lining with certain types of synthetic rubber or plastic. The method of design of reinforced concrete tanks used by this company was described by a representative of the company at a meeting of engineers in New York. This paper is presented in part as follows:

By Curzon Dobell, The Preload Co.

The theory of reinforced concrete design has not in the past adequately covered characteristics of reinforced concrete that are of the greatest importance when applied to the construction of containers and carriers of liquids.

The full value of concrete and steel cannot be obtained when the two are bonded together because each material is restricted by the other with a consequent reduction in the value of both.

Under the Preload System of concrete construction all the disadvantages inherent in conventional reinforced concrete designs are eliminated. The reinforcing rods and the concrete are not bonded together until after the steel has been stressed.

The concrete shell is first erected without reinforcement. After a sufficient setting period, the hoops and vertical rods are installed and stressed or tightened to a predetermined amount exactly calculated and tested by extensometer readings taken by the field engineer.

When a load is applied to steel reinforcement, the steel will stretch or shorten in direct proportion to the amount of the load. If a load of 1000 lbs. is placed on a steel reinforcing rod it will stretch or compress a certain amount depending on the area of the cross sections; if the load applied is 10,000 lbs. then the change in length will be 10 times as much. Measurements have determined exactly how much this change is per pound of stress and it is set up in a figure called the Modulus of Elasticity.

*"100,000-Barrel Concrete Tanks for Fuel Oil Built by Prestressing Reinforcing Rods" Technical Section, NPN, Jan. 6, 1943.

The Modulus of Elasticity for steel averages 30,000,000 lbs., and for concrete about 3,000,000 lbs. This figure is obtained by dividing the unit stress applied by the unit of deformation, or strain obtained, and is constant up to the elastic limit of the material being stressed. By elastic limit is meant the amount of unit stress beyond which a material will take a permanent deformation; for steel the point above the elastic limit is termed the yield point and is the amount of applied unit stress beyond which the steel will deform rapidly under very little additional stress. Steel for tank purposes can be considered perfectly elastic to the elastic limit, and safe to the yield point.

In tanks of usual design, the stress of steel reinforcing rods under applied loads is a critical factor; low working stresses must therefore be used to keep this stretch to a minimum. Steel is exceptionally strong in tension, but concrete, for the purpose of design, has been considered to have no tensile strength. In ordinary reinforcing, the steel and concrete are bonded together and must therefore act as a unit. Theoretically the steel takes the tension and the concrete is supposed to be unstrained in this respect.

This, of course, is not true in practice.

Tensile Strengths Differ

For each pound of load applied, as a tank is filled, the steel will elongate a definite amount, and, since the concrete is bonded to it and subject to the same loading, it must also elongate exactly the same amount. Now, if the Modulus of Elasticity of steel is 30,000,000 lbs. and that of concrete 3,000,000 lbs., then the stress ratio is at 10 to 1, and the unit stress of concrete under load will be 1/10 of that in the steel. If the unit tensile stress for steel is 12,000 lbs. under load, then the concrete is required to take a unit load of 1/10 of this amount, or 1200 lbs. This it is unable to do because its tensile strength is not more than one-half of this amount; the concrete therefore breaks. The hope is that the breaks will be numerous and the openings small.

Under the Preload System, all the disadvantages inherent in conventional reinforced concrete design are eliminated. Concrete and steel are no longer bonded until after the steel has been stressed.

The construction is begun with the stresses in proper relation. The steel is loaded during construction and its friend, the concrete, serves as the load and continues in this capacity until the tank is filled. The weight of the liquid then takes over the load and frees the concrete.

To put it in a few words, it is a method of concrete construction whereby the steel reinforcing is preloaded against the concrete with which it is combined in such a way that the live load causes the concrete to give in compression instead of being stressed in tension; in this way all cracking due to loading, shrinkage, or temperature changes is eliminated within the limits of design factors.

Another Source of Cracking

There is another source of cracking in concrete tank walls in addition to that induced by the hydraulic load. In the wall there is a great difference in temperature between the outside and the inside. During the summer, the outside surface of the wall will reach a relatively high temperature, while the inside remains at the temperature of the water or other liquid. In the winter the condition is reversed. It follows that the warmer surface will be longer than the cooler one whether it be outside or inside, with the result that vertical tension and unbalanced stresses will be set up in the walls. During the summer, the inside surface will crack due to this tension; when the temperatures are reversed due to a change in seasons, the tension is on the opposed or outside surface, and cracking will occur at the weak sections which, naturally, will be at the points opposite the cracking which has already taken place on the inside. The result is a true crack, water leakage, discoloration, and eventual failure.

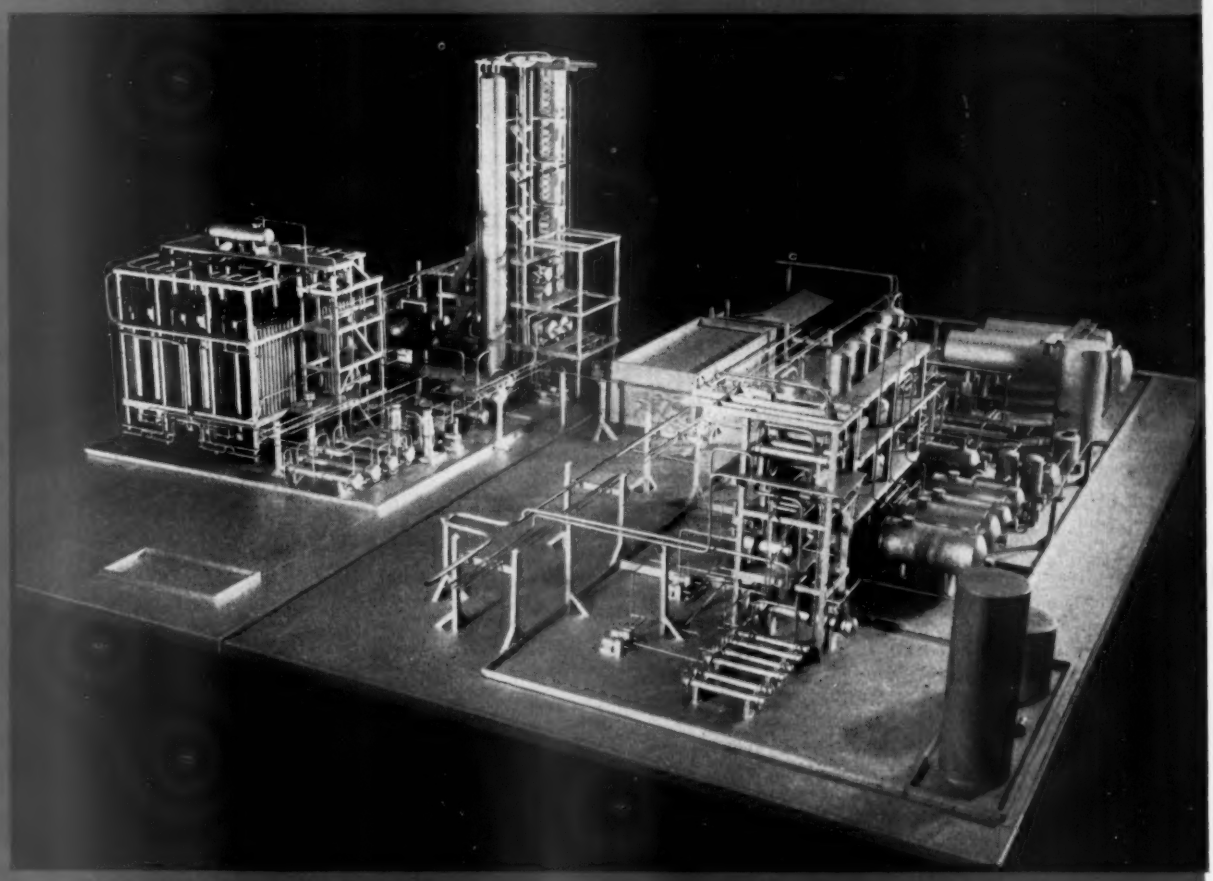
In the Preload System this condition is overcome by the introduction of vertical preloaded rods. The wall is placed in a vertical compression to an amount which offsets the tension due to temperature changes. The temperature changes merely result in the release of compression, and the concrete at no time is subject to tension. The proper amount of stressing in the vertical planes is a matter of careful calculation.

The construction of a dome is also an important feature of Preload design. In the case of the two large oil storage tanks built for a Canadian company, the diameter is 130 ft. with a dome thickness in relation to size, of less than 1/10 the thickness of an eggshell. This type of dome construction is adaptable to covering any large enclosure where supporting columns are not wanted. The dome is supported on a ring abutment. This abutment is encircled with preloaded hoops which take the full thrust of the dome.

Comparative Quantity of Steel Required in Oil Storage Tanks Showing How Steel Can Be Saved by Pre-Stress Design

Tank Size			Steel	Rods—Mesh	Wire—Mesh	Pounds of Steel per Bbl. of Capacity		
I.D. Ft.	Ht. Ft.	Capacity in Barrels	Plate (A.P.I.) in lbs.	Dowels—Etc. in lbs.	Dowels—Etc. in lbs.	Steel Plate Tanks	P.L. Rod Tanks	P.L. Wire Tanks
144	37' 7"	100,000	850,000	267,000	95,000	8.50	2.67	.95
78	26' 6"	25,000	202,000	48,000	22,000	8.09	1.92	.88
78	35' 0"	30,000	235,000	73,000	28,000	7.84	2.43	.93
78	43' 6"	37,500	300,000	107,000	36,000	8.00	2.85	.96
102	37' 8"	55,000	411,000	138,000	49,000	7.48	2.50	.89

Model Plant TODAY...



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CONTRIBUTIONS TO RESEARCH IN OIL

From the American Chemical Society Meeting

By B. H. Weil*

MANY papers of direct and indirect interest to the petroleum industry were presented before the various divisions of the American Chemical Society at its 106th meeting in Pittsburgh, Sept. 6 to 10. Held without the plant inspection trips and social frills of peace times, the meetings were devoted chiefly to those aspects of the chemical industries which relate directly to the war effort. In addition to numerous strictly technical papers, symposia were held on such important topics as war manpower problems, research management, and technical library techniques. General registration exceeded 3200, and more than 270 chemists attended the Petroleum Division's banquet.

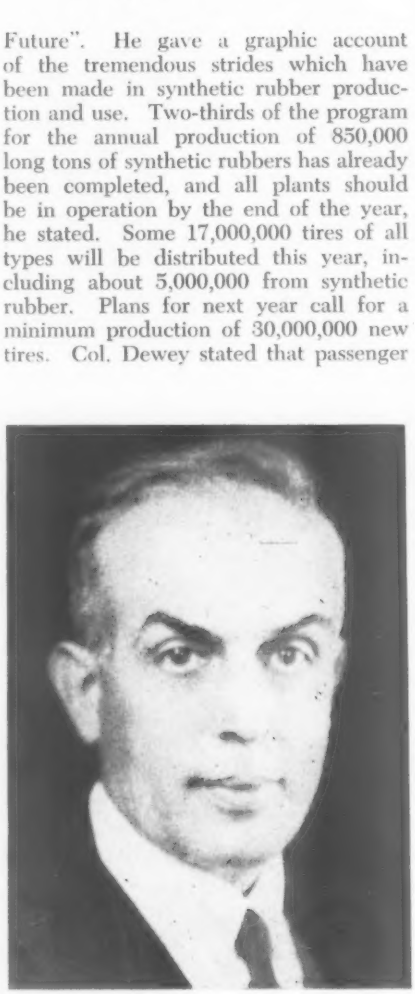
Petroleum Prospects

At the general meeting Sept. 8, two significant papers were presented. Per K. Frolich, of the Standard Oil Development Co., the president of the Society, gave an address entitled "Petroleum—Past, Present and Future." He reviewed the status of fuel resources of all types, taking a temperately optimistic view on petroleum reserves. The U. S., he believes, will ultimately produce about 100 billion barrels out of some 600 billion barrels at which world reserves were estimated. About 46 billion barrels of oil have been discovered so far in this country, half of the estimated potential supply. It may be 300 years or more before the world runs out of oil, he stated, although long before this happens there will be heavy use of petroleum substitutes made from natural gas, oil shales, tar sands, and coal. Reserves of the latter three materials, especially coal, exceed those of petroleum. The use of petroleum substitutes, however, will cause a gradual rise in the cost of petroleum products.

Dr. Frolich reviewed for the society the basic economics of the petroleum industry. He stressed the overwhelming importance of petroleum's role in the present war and the problems of supply which are plaguing the industry. He expressed the belief that the chemical and engineering faculties of the nation will solve the problems of petroleum shortages and substitutes when they arise and that better uses will be made of the better petroleum products of the future.

Synthetic Rubber

Col. Bradley Dewey, newly-appointed Rubber Director, spoke on "The Synthetic Rubber Program—Present and Future". He gave a graphic account of the tremendous strides which have been made in synthetic rubber production and use. Two-thirds of the program for the annual production of 850,000 long tons of synthetic rubbers has already been completed, and all plants should be in operation by the end of the year, he stated. Some 17,000,000 tires of all types will be distributed this year, including about 5,000,000 from synthetic rubber. Plans for next year call for a minimum production of 30,000,000 new tires. Col. Dewey stated that passenger car tires made from GR-S (Buna-S) synthetic rubber already are better than all but the top-grade, first-line prewar tires, and that the quality of heavy-duty tires, which still require 10 to 30% of natural rubber in their compounding, is being rapidly improved. The output of cotton tire cords will have to be increased, he stated, and these will be used along with rayon cords for the heavy-duty tires. The latter will require continued use of some natural rubber until an increased supply of rayon cords becomes available.



Cary R. Wagner, consultant, is the new secretary of the A. C. S. Petroleum Chemistry Division. For several years he was chief chemist for Pure Oil Co. and chairman of the company's refinery control board. He served as a technical adviser to the Office of Petroleum Coordinator in Washington during the early months of the war

Sincere praise was given the petroleum, chemical, and rubber industries for their technical accomplishments in making synthetic rubber a reality. Better synthetic rubbers both of the present and newer types may be expected to result from the research now under way, Col. Dewey said. He challenged the chemists of America to so improve their processes and develop new ones that synthetic rubbers may stand on their own feet in peacetime. He predicted that synthetic rubbers will continue to fill at least part of the demands for elastic materials after the war.

The Division of Petroleum Chemistry held its sessions Sept. 9 and 10. Thirteen general papers had been scheduled for the first day, but one paper, "Methods for Determining the Activity of Cracking Catalysts", by Charles L. Thomas, Gustav Egloff, and James Hoekstra of the Universal Oil Products Co., and Wilbur C. Strand of the Blaw-Knox Co., had to be withdrawn because of war secrecy requirements. Another paper, "Sulfuric Acid Extraction in Hydrocarbon Type Analysis," by C. C. Allen and H. W. Duckwall of the Anderson-Prichard Research Laboratory, was not presented due to absence of the authors, but it has appeared in the preprints of the Division and probably will be published later.

According to the abstract, "Sulfuric acid absorption experiments were carried out on a paraffin-naphthene-kerosene fraction containing known proportions of various benzene and naphthalene derivatives. It was found that employing several different ratios of 101% acid to oil and extrapolating to zero acid to oil ratio, the complications due to incomplete removal of unsaturates, solubility of saturates in the extract, and attack of the acid on the saturates could be avoided. The data obtained on hydrocarbon mixtures and the saturated sulfuric acid raffinates by the extrapolation method could be combined to give information on the unsaturated constituents."

Sulfur From Waste Gases

Another paper dealt with the "Recovery of Sulfur from Sulfur Dioxide in Waste Gases." T. F. Doumani, R. F. Deery, and W. E. Bradley, of the Union Oil Co. of California, were the authors. They discussed a two-step catalytic process for treating wet gases containing relatively low percentages of sulfur (1-3%). The sulfur dioxide-containing gas is mixed with hydrogen in the first step and passed through a catalyst bed at temperatures above 300°C., a gel-type catalyst comprising about 25% iron sulfide and 75% alumina having been

*Information Section, Chemistry Division, Gulf Research & Development Co., Pittsburgh.

found effective. The following reactions occur:

$$2\,SO_2 + 4\,H_2 \rightleftarrows S_2 + 4\,H_2O \quad (1)$$

Sulfur dioxide, Hydrogen, Sulfur, Water

$$2\,H_2 + S_2 \rightleftarrows 2\,H_2S \quad (2)$$

Hydrogen, Sulfur, Hydrogen sulfide

$$3/2\,S_2 + 2\,H_2O \rightleftarrows 2\,H_2S + SO_2 \quad (3)$$

Sulfur, Water, Hydrogen sulfide, Sulfur dioxide

"In Step 2 (equation 4), complete conversion to elemental sulfur is accomplished by passing the mixture of hydrogen sulfide and sulfur dioxide from Step 1 over activated alumina at temperatures of 100° to 200°C.":

$$2\,H_2S + SO_2 \rightleftarrows 3\,S + 2\,H_2O \quad (4)$$

Hydrogen sulfide, Sulfur dioxide, Sulfur, Water

Sulfur deposits upon the catalyst bed, but this bed may be reactivated by raising its temperature to above 500°C. The authors mentioned that the process was developed in connection with hydroforming operations upon high sulfur crudes, during the processing of which the sulfur is largely eliminated as sulfur dioxide. Since the hydrogen required is readily available from the hydroforming plants, the authors believe that the economics of sulfur production by this process are promising.

Gasoline Analysis

Lester Steffens and Donald P. Heath, of Socony-Vacuum Oil Co., Inc., authors of a paper entitled "An Automatic Distillation Apparatus for Gasoline Analysis," state in their abstract:

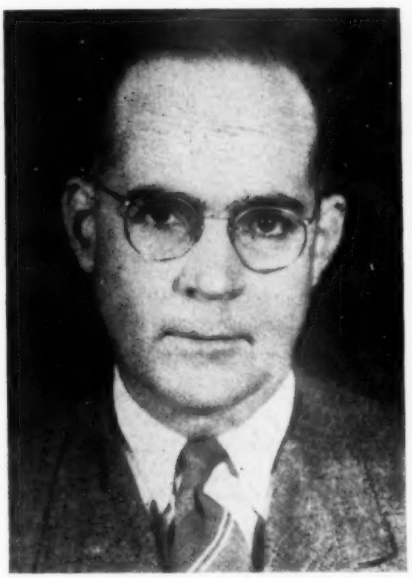
"Precise distillation is one of the major tools available for gasoline analysis, but operation at the necessary high reflux ratios results in a time requirement of as long as several weeks for distillation of a single sample. To expedite such work, an automatic distillate collector was constructed for use with a Podbielniak Super-Cal distilling apparatus, to permit continuous operation with a minimum of attention from the operator. Successive distillate fractions are measured in a float chamber and emptied automatically into bottles. The boiling point of the distillate is recorded continuously. The apparatus can be operated for a 16-hour period without attention from the operator."

Cyclization Effects

An important phase of American Petroleum Institute Project No. 42 was summarized in a paper prepared by R. W. Schiessler, Pennsylvania State College; D. G. Clarke, Rohn & Haas Co.; C. H. Herr and F. C. Whitmore, Pennsylvania State College; and J. N. Cosby, General Aniline and Film Co. Entitled "The Effect of Cyclization on the Physical Properties of Higher Hydrocarbons," it stated that cyclization invariably increases the boiling point, has a variable effect on the melting point (molecules of high symmetry having higher melting or pour points than less symmetrical ones), increases the viscosity greatly, decreases kinematic viscosity index, increases both density and refractive index, and decreases the aniline point.

Furfural Miscibility Solution Temperatures

Considerable interest was evidenced in a paper entitled "Furfural Solution Temperatures of Hydrocarbons. I. Evaluation of Mixed Aniline Point Determination and Application of Furfural." This paper was prepared by Harry T. Rice and Eugene Lieber of the Standard Oil Co. of New Jersey. According to the abstract of their paper, "the solvency characteristics of various petroleum fractions of the type of solvent oil, solvent naphtha, Diesel fuels, various gas oils, etc., constitute an important index as to the properties such products will display in use. The determination of these characteristics has been an important task of the petroleum technologists, and various methods have been devised for their evaluation. Of these methods, those based upon the miscibility solution temperature of the oil and a solvent liquid are among the most important."



C. L. Brown, re-elected chairman of the Petroleum Chemistry Division of the American Chemical Society, director of research and development for Standard Oil Co. of Louisiana, Baton Rouge

The authors, after presenting much indicative data, concluded that "the aniline point method, though widely used, has the disadvantage of using a toxic reagent and has limited applicability to low aromatic content petroleum fractions. * * * * Furfural offers considerable promise as a reagent for the determination of miscibility solution temperatures. It is nontoxic and is directly applicable to petroleum fractions of high aromatic content, making possible the elimination of the mixed aniline point determination."

In a paper entitled "The Permeability of Hydrocarbon Gases Through Rubber Tubing," J. R. Riley, M. J. Stross, and H. M. Eby of the Universal Oil Products laboratories concluded, to quote their paper's abstract:

"Hydrocarbon gas permeation for planar films of rubber varies inversely with thickness of the film and directly with the area. Likewise, permeation of gases through rubber tubing varies directly with the inside diameter, and inversely with the wall thickness. For a single type of rubber tubing, the permeability of different gases varies over a wide range. In general, olefins permeate rubber more rapidly than paraffins; hydrocarbons of the C_4 range much more rapidly than those of lower molecular weight. Synthetic rubbers, — e.g., neoprene and particularly Koroseal — are far less permeable than any compounds of natural rubber tubings. Plastic tubings such as Resistoflex are much superior to either synthetic or natural rubber. Synthetics of the Buna and Butyl type were not investigated."

Acidity Determination In Colored Materials

Louis Lykken, P. Porter, H. D. Ruliffson, and F. D. Tuemmler of the Shell Development Co. presented a paper on the "Potentiometric Determination of Acidity in Highly Colored Materials. Applications to New and Used Petroleum Lubricants Containing Additives." After presenting considerable data on this topic, they concluded that "in the determination of acidity in complex mixtures, such as lubricating oil, or organic distillates, any information which helps to identify the acidic constituents may prove valuable. The potentiometric titration gives such information, and, in addition, it furnishes a record of just what took place during the analysis of any sample."

In a paper bearing the title "Bicyclo (2,2,1) Heptane and Bicyclo (2,2,1)-2-Heptene," Charles L. Thomas of the Universal Oil Products Co. reported on the properties of these substances, which were prepared from cyclopentadiene and ethylene (followed by hydrogenation for the preparation of the heptane). Both of these compounds are white crystalline solids. A.S.T.M. octane numbers were determined on blends of 2,2,4-trimethylpentane, n-heptane and the hydrocarbon. The bicycloheptene had a blending octane number of 95±5, and the bicycloheptane, 56±5. The latter was far lower than anticipated from structural considerations.

Physical Data Methods

Three papers on theoretical methods of determining various physical data of hydrocarbons were presented at the meeting of the Petroleum Division. One of these, entitled "Liquid Densities of Volatile Hydrocarbon Mixtures", prepared by G. H. Hanson of the Phillips Petroleum Co., and R. D. Kuist and G. G. Brown, University of Michigan, stated (in the paper's abstract) that "the use of apparent densities for methane and

ethane in the liquid phase, suggested by Standing and Katz for estimating the density of crude oil saturated with natural gas at high pressure, has been extended to liquid mixtures of volatile hydrocarbons as found in natural gasoline. The results agree with the experimental data in a satisfactory manner. At the present time this appears to be the most reliable method for estimating the density of liquid petroleum and natural gas mixtures from the composition of the mixture."

"Thermal Properties of Hydrocarbons" was the title of the second of these papers, prepared by J. F. Fallon and K. M. Watson of the University of Wisconsin. According to the authors:

"Improved correlations applicable to various types of hydrocarbons are developed for heat capacities in the liquid and ideal vapor states, and heats of vaporization. These correlations are based on consideration of the data recently developed from spectroscopic measurements and are made mutually

R. E. Burk, re-elected vice-chairman of the A. C. S. Division of Petroleum Chemistry, is director of research for Standard Oil Co. of Ohio, also professor of chemistry in the graduate school of Western Reserve University

consistent with each other by generalized thermodynamic methods. Enthalpies calculated from the resultant charts are in good agreement with calorimetric data on petroleum fractions."

The third paper in this group, by B. W. Gamson, Great Lakes Carbon Corp., and K. M. Watson was entitled "Vapor Pressures of Organic Compounds." The authors' abstract states:

"Two new forms of vapor pressure equations are developed, one satisfactory for the range from 0.1 mm. of Hg to the critical point and the other from 0 - 100 mm. of Hg. The equations are applicable to all types of materials with errors generally less than 2% for the equation representing the range 0.1 mm. of Hg to the critical point. For homologous series of organic compounds generalizations are developed for the prediction of critical pressures and the constants of the vapor pressure equations. For a member of the 15 series of compounds investigated, these generalizations permit estimation of a complete vapor pressure curve from a single experimental value such as the boiling point."

A paper presented before the A.C.S. Division of Organic Chemistry on Sept. 7 deserves mention here. Entitled "Higher Paraffin Hydrocarbons. Correlation of Physical Properties," and prepared, by Alfred W. Francis of the Socony-Vacuum Oil Co. it dealt with methods of computing the physical properties of paraffin hydrocarbons above C_{11}. Previous papers had been presented on hydrocarbons lower than C_{11} [Ind. Eng. Chem. 35, 442 (1943)].

Pilot Plant Problems

The Sept. 10 sessions of the Petroleum Division were devoted to a "Round-Table Discussion on Pilot Plant Design, Construction, and Operation," with R. E. Burk of the Standard Oil Company of Ohio, presiding.

In the morning, Nathan Fragen of Standard Oil Co. of Indiana presented a basic discussion of pilot plant problems on "Pumps and Compressors," including such topics as capacity and means of control, corrosion resistance, special pumps and compressors, packing gland difficulties, and problems of adaptation. Hugh W. Field, W. T. Hirsch, and William E. Chalfant of Atlantic Refining Co., served as discussion leaders on the topic of "Heating and Cooling Equipment," also presenting in a paper a discussion of such phases of the problem as preheating, heat loss control, and cooling.

"Temperature and Pressure Measurement and Control" were discussed by W. H. Barcus of Sun Oil Company. W. C. Offutt, Gulf Research & Development Co., discussed certain aspects of "Manual and Automatic Valving for Continuous and Cycling Operations in Connection With Pilot Plant Design, Construction, and Operations." The proper selection of valves to meet particular types of applications was stressed, and a discussion of valve limitations and assets was given. C. M. Thacker and H. O. Folkins, of Pure Oil Co., reviewed various aspects of "Fluid Flow Control and Measurement," and Charles Richker of the Texas Co. concluded the morning's program by serving as discussion leader on "Stabilization, Fractionation, Contacting, and Separation." His paper dealt with a discussion of the types of pilot plants and the design and construction of the equipment needed for their operation.

The afternoon session was held in the form of an informal open forum on the topics presented during the morning.

The Division of Industrial and Engineering Chemistry held an important "Symposium on Manpower Problems in the Chemical Industry." Albert L. Elder, chief chemical advisor to the War Production Board, stated that the most serious problem confronting the chemical industry today is that of manpower. He stressed the need for correlation of training and occupational deferments and the importance of anticipating future needs as well as today's requirements. Training programs for chemists and chemical engineers, respectively, were discussed by Herman T. Briscoe of Indiana University, and Warren L. McCabe of Carnegie Institute of Technology. Deferment procedures were outlined, and constructive suggestions were made as to changes in present draft policies regarding educational programs.

James Coull of University of Pittsburgh, discussed the need for training women to replace men at the operator's level in a paper entitled, "Training of Women Operators for Chemical Industry." "Occupational Deferment of Technically Trained Men in the Chemical Industry" was the topic of a paper by Frank C. Whitmore of Pennsylvania State College, the important aspects of the problem being reviewed. James W. Raynolds of the War Manpower Board, discussed "Production Requirements of the Chemical Industry" in a manner fully appreciative of the problems confronting the maintaining of a high level of output if technical man power is not husbanded.

Francis J. Curtis of Monsanto Chemical Co. in a paper entitled "How Industry is Solving Its Manpower Problems," listed several ways in which these problems are being met. These methods include careful study of the Selective Service Act, personal contact with component parts of the Selective Service System, use of Replacement Schedules and Manning Table Plans, close contact with WMC-USES, analysis of all jobs, review and improvement of upgrading systems and supervisory training programs, voluntary extension of the work week, and careful attention to safety devices and practices. He also urged the employment of women and the use of substandard and older men. The symposium was concluded with an address by Sidney D. Kirkpatrick, Editor of *Chemical and Metallurgical Engineering*, who discussed "Chemical Manpower for Postwar Industries." He predicted that chemical manpower will again be abundant after the war and presented suggestions to avoid dilution and depression of the general level of professional competence.

Research Management

Another important symposium held by the Division of Industrial and Engineering Chemistry was the "Second Research Management Symposium," devoted chiefly to aspects of the problem relating to small and medium-sized chemical industries. Papers presented at this symposium, just as those on manpower prob-

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lems, bear direct relationship to the petroleum industry, since both the chemical and petroleum industries share many of the same problems of manpower, research, and operations.

In a paper entitled "Research Management in a Medium Sized Chemical Business," Charles L. Gabriel of Publicker Commercial Alcohol Co. stated that a medium-sized chemical business (one making an annual profit of $3,000,000 to $15,000,000 before federal income and excess profits taxes) should spend for research and development some 5 to 10% of gross profits, not too large a figure when considering the necessity for such work and the fact that in many cases taxes would claim 75 to 80% of profits not so devoted. A research and development department should preferably be divided into four parts to handle: (1) small scale laboratory research, (2) design, installation, and operation of semicommercial equipment, (3) patents, and (4) sales development. Expenditures for such sections, respectively, should approximate 50%, 30 to 40%, 5 to 10%, and 5 to 10% of total research outlay. The functions of these various research sections were outlined.

'Small Business Research'

Charles H. Egan of Dewey and Almy Chemical Co., presented a paper on "Small Business Research" which stressed the point that problems and techniques involved are similar to those for large companies, while the need is so great that expenditures for research often amount to 4 to 5% of gross sales. "Specialized Research A La Carte" was the topic of a paper by C. L. Knowles of The Dorr Co. Inc., who cited costs and specific cases in which small companies were able "to get their research done efficiently and economically by engineering organizations experienced in various types of work. This service can be purchased by the day on a cost plus basis, or contracts made to cover any specific problem."

Discuss Mellon Institute

Considerable discussion followed the presentation of a paper, "Mellon Institute and the Fellowship System of Industrial Research," given by George D. Beal of the Institute. The history, aims, facilities, and techniques of industrial research at the Mellon Institute were described, and a detailed picture given as to donor-Institute relations. It was brought out that the average one-man (Ph.D.-level) fellowship costs approximately $7000 to $7500 per year. Many of the fellowships are of this size.

The final paper, "Management and Research Consultants," was prepared by Raymond Stevens and Earl P. Stevenson of Arthur D. Little, Inc. The abstract of the paper states: "Whereas all research laboratories have opportunities for use of consultants, the more restricted budgets of smaller companies necessitate special care. Many of the same factors that bear on establishment of an internal research program affect the choice and use of a consultant. Most effective use of a research consultant calls for proper preparation and action by the company, and mutuality of interest should be established." The authors said that the average cost of maintaining a research worker exceeds $4000, and also frankly declared that the use of consultants was not merely a method to avoid company research expenditures but rather a means for all organizations to acquire needed knowledge which they themselves were not equipped to obtain and for which the provision of special research facilities would not prove far-sighted.

After-paper discussion brought out clearly that the use of consultants is not an alternative to the establishment of college fellowships; the latter is a device for a broad research program, while the former should be used when a process or product approaches the commercial stage, since colleges cannot, in all fairness, be expected to keep research developments strictly confidential. Interesting figures on research expenditures were presented in the paper, it being stated that "a median ratio of research expenditures to gross sales among companies conducting research is 2% and this ratio increases as company capitalization decreases, until companies under $1,000,000 average 2.5%, and the smallest companies, with a capitalization of from $20,000 to $75,000, are reported to spend 5% of gross sales income on research."

Technical Information

A paper entitled "Information Service and the War Effort," given at a general meeting of the Division of Industrial and Engineering Chemistry, and a symposium on "Technical Library Techniques," presented before the Division of Chemical Education, provided much informative material on the techniques and uses of the scientific literature. In the first paper, B. H. Weil and W. H. Deitch of Gulf Research & Development Co. listed some of the important functions of an information service as "(1) summarization of existing knowledge; (2) provision of information on current developments, gleaned from journals and the patent literature; and (3) preparation of patent surveys, which may analyze information not available elsewhere and may point to more efficient processes of importance to the war effort." Stress was placed on the husbanding of scarce technical man power through proper use of an information service, and examples of such use were given.

Library Techniques

The "Symposium on Special Library Techniques," presented on Sept. 7, contained 16 papers, whose titles only will be listed here, but whose contents are pertinent to petroleum libraries and research. These are: "The Importance of Technical Writing in Chemical Education," by Florence E. Wall (General Aniline and Film Corporation); "Publications—Pitfalls and Problems," by M. G. Mellon (Purdue University); "Abstracting and Indexing," by E. J. Crane (Chemical Abstracts); "Rules for the Preparation of Book Manuscripts," by John Sasso (Product Engineering); "Slips That Pass in the Night: A Plea for Accuracy in Printed Material," by E. H. McClelland (Carnegie Library, Pittsburgh); "Problems of the Scientific Literature Survey. II. The Chemical Literature Research Staff and Organization," by Gustav Egloff, Mary Alexander, and Prudence Van Arsdell (Universal Oil Products Co.); "The Technical Library and Undergraduate Research," by W. B. Meldrum and T. O. Jones (Haverford College); "Operating A Technical Library Under A Library Committee," by Caroline W. Foote (U.S. Bureau of Mines, Pittsburgh); "Keeping Up With Technical Books," by Edith G. Portman (Mellon Institute); "Trade Journals and House Organs," by H. A. Marple (Monsanto Chemical Co.); "Literature Service for Fuel Chemists," by Julian F. Smith (Institute of Gas Technology); "The Use of Microfilm in the Research Library," by Ross C. Cibella (Hall Laboratories); "Library Versus Laboratory Research," by A. G. Connolly (du Pont); "The Importance of Scientific Literature in Patent Applications," by Paul J. Culhane (du Pont); "Patent Service—An Arm of Research," by Wilfred W. Smith (du Pont); and "The Contribution of the Alien Property Custodian's Office to Chemical Research," by Dexter North (Office of Alien Property Custodian).

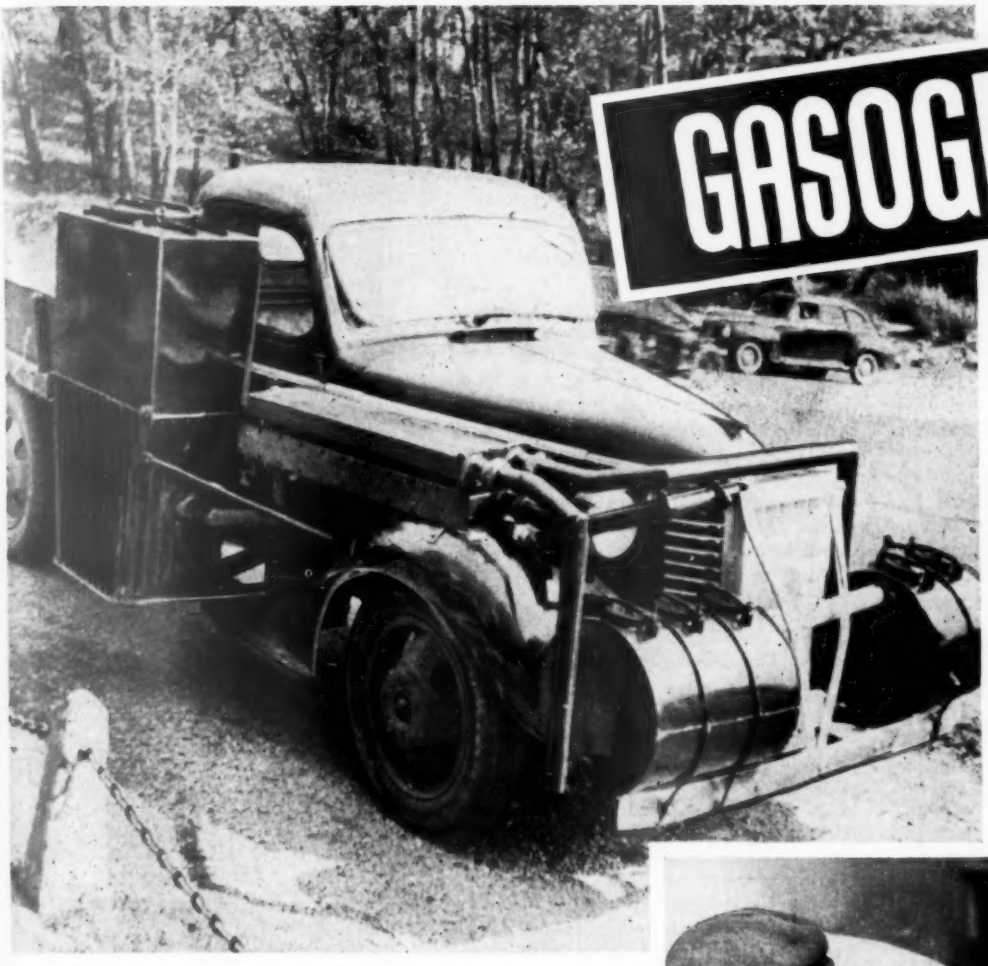
Coal Hydrogenation

A "Round Table Discussion on Coal Hydrogenation," led by H. H. Storch of the U.S. Bureau of Mines, Pittsburgh, was held by the Division of Gas and Fuel Chemistry. Much basic data and interpretations thereof were exchanged. Among other items of interest, it was revealed that the m-cresol to p-cresol ratio in the tar acids obtained from coal hydrogenation is 43:57, as contrasted with a ratio of 57:43 in tar obtained from high-temperature coking operations. Phenol (7.4%), o-cresol (4.3%), m-cresol (7.3%), p-cresol (9.7%), and xylenols (29.0%), comprise some 60% of the tar acids obtained from a coal hydrogenation sample, as compared with percentages of 35, 14, 17, 13, and 21, respectively, for the same tar acids from coking operations. Yield of tar acids from coal hydrogenation were said to be some 10 times the corresponding amount from coking.

Before the Division of Organic Chemistry, R. C. Jones and M. B. Neuworth of Carnegie Institute of Technology presented a paper entitled "Chemical Nature of Primary Coal Hydrogenation Products." Through chromatography, vacuum distillation, and the formation of crystalline addition complexes, various products were isolated and identified as alkyl benzenes, alkylated naphthalenes, and hydroaromatics containing a naphthalene nucleus.

GASOGENES

Substitute Solid Fuels for Equivalent of 25,000,000 Bbls. of Gasoline a Year*



Above, a producer gas generator, coolers and filter, mounted on a truck in Canton, N. C., for experimental purposes. Charcoal was used as fuel

Right, fueling a gas producer taxi in Paris with hard coal. France was operating gasogenes before the war

Stern war necessity has brought about the operation of 815,000 producer gas vehicles, in many countries, substituting a variety of solid combustibles for fuel for the equivalent of 25,000,000 bbls. of gasoline a year. Use of the gasogene vehicles in any number has come about entirely since the start of the war, in countries which lack petroleum or other types of gasoline substitutes.

In 1938 Europe operated about 9000 gasogene buses and trucks and only a few were in use on any other continent. In 1942 around 350,000 were reported in use in Germany alone, 110,000 in France, 100,000 in Russia and nearly 80,000 in Sweden (See Table 1.) Several countries with no petroleum production are today commercially manufacturing gasogene vehicles, among them Australia, Brazil and Chile.

The solid combustibles used for fuel include wood, wood char, coal (anthracite, brown, bituminous, lignite and coke), peat, corn cobs, grain wheat, flax waste, coffee husks, nut shells, cotton seed, sugar cane branches and lignin. Charcoal, wood and coal are utilized to a greater extent than all other fuels. (Table 2.)

If gasoline rationing continues in the U. S. until some sections are actually deprived of transportation, some authorities believe automobiles may be converted to producer gas vehicles in certain areas where wood or other solid fuels are plentiful. Other factors than availability of suitable fuels, however, will help determine the extent to which producer gas vehicles are used. Among these factors are the scarcity of steel and alloy metals required for the gas producing equipment, lack of facilities to manufacture it, and shortage of manpower for converting engines to run on producer gas.

The wide variety of fuels used in the gasogenes presents problems not encountered with gasoline engines; among them the deposition of tars and acids, corrosion of equipment, clinkering, and the necessity for cleaning out ashes. The varying types of gas producer equipment must be carefully considered for the type of fuel. The types generally

*A review of a paper "Motor Vehicles Propelled by Producer Gas", by Gustav Egloff and Prudence Van Arsdell, Universal Oil Products Co., Chicago, presented before the Petroleum Division, American Chemical Society, Pittsburgh, Sept. 5-10, and including additional comment by the authors.

used fall in 4 categories, described as follows:

Up-draught Producers

In this type of producer (Fig. 1) the various zones of chemical reaction are layered horizontally and the flow of air and gas is in an upward direction and countercurrent to the fuel flow. Considered most efficient from the thermal point of view, for fuels producing tarry substances this method entails the necessity for providing effective means of preventing tarry matter from reaching the engine.

Up-draught producers use low-temperature cokes, anthracite, charcoal and charcoal briquets as fuel. They are considered to give better quality of gas than other types, and are easiest for starting the engine. Gasification is carried out at moderate velocities and in most cases steam or water is added to the entering air stream. There is better flexibility with water, and servicing and cleaning intervals are longer.

Down-draught Producers

In this type (Fig. 1) flow of air and gas is downward concurrently with the fuel. These units use mainly wood charcoal, charcoal briquets, raw wood or coal or mixtures. They are characterized by their ability to burn the tarry distillates and fuel dust but they suffer to some extent from uneven thermal balance. Water is not used in the gasification but some manufacturers of the equipment claim that charcoals containing up to 25% of moisture can be used with full efficiency.

Cross-draught Producers

Here the flow of air and gas is across the producer though not necessarily in the same horizontal plane. Fuel flow is downward. The object of this design (Fig. 1) is to concentrate the combustion and reduction zones in a small space. Gasification is achieved by admitting air at very high velocity into the fuel bed through a narrow water-cooled tube, which results in the development of high temperatures. This type of gas producer is characterized by simplicity of construction and quick starting of the motor.

The cross-draught producer gas equipment was recommended by the Committee on the Emergency Conversion of Motor Vehicles to Producer Gas in Great Britain, as the most practical expedient to change gasoline automobiles to run on home produced fuels in case a wartime blockade shut off gasoline supplies. The recommended equipment was described as follows in the Committee's report:

"The Emergency Producer consists merely of a thin steel cylindrical shell, approximately 4 ft., 6 in. high and 1-ft. 6 in. in diameter, fitted with a fuel charging door at the top, and ash discharging door at the base, and air intake or tuyere, and a gas offtake protected by a detachable grid. The tuyere is water-cooled, the heat from the cooling water being dissipated from an annular radiator tank fitted around the upper part of the producer shell.

"The number of parts has been reduced to a minimum; for example, no use is made of water injection and there is no clinker removing apparatus. The plant is built throughout of mild steel plate, which is relatively cheap, and no special metals or complicated processes are employed in its manufacture. Even the tuyere, the correct functioning of which is of vital importance, is of simple design and constructed of mild steel.

"For ease of production in quantity, the maximum use is made of pressings, including the tuyere, and the top and base of the shell. The doors also are simple pressings and are interchangeable.

"The use of the annular radiator tank makes the unit self-contained and independent of the engine cooling system. This is of importance for ease and cheapness of fitting the producer, either in the lorry itself or on a trailer unit. Incidentally it makes the system more foolproof. . . . .

"In the Committee's design of equipment for mounting on a trailer, the gas leaving the producer passes in series through 4 cylindrical coolers, each about 3 ft., 6 in. long and 6 in. in diameter, arranged two on either side of the chassis.

Table 1

(Maximum Number of Producer Gas Vehicles Reported in Use in 1942, by Countries)

Country	Number Vehicles
Axis	
Germany	350,000
France	110,000
Italy	35,000
Holland	1,000
Slovakia	50
Belgium	15,000
Denmark	20,000
Norway	3,500
Total	534,550
Neutral	
Sweden	72,755
Switzerland	15,000
Spain	2,200
Portugal	450
Ireland	1,100
Total	91,505
Allied	
Britain	10,000
Australia	45,000
S. Africa	100
Scotland	47
India	10,000
Russia	100,000
China	500
Brazil	22,000
Chile	1,000
Canada	1
U. S. A.	6
Total	188,654
World Total	814,709

Table 2

Fuels Used in Gasogene Type Vehicles

Wood

Charcoal
Wood (green or dried)
Sawdust
Shavings
Chips
Waste
"Generator"
Wet

Coal

Brown
Lignite
Anthracite
Coke (low temperature)
Coke (high temperature)
Coke (breeze briquet)

Peat

Peat (dried)
Peat (carbonized)
Peat Coke
Peat (briquet)

Miscellaneous

Corn cobs
Flax waste
Lignin
Grain wheat
Coffee husks
Nut shells
Cotton seed
Sugar cane (branches)
Grape seeds
Straw

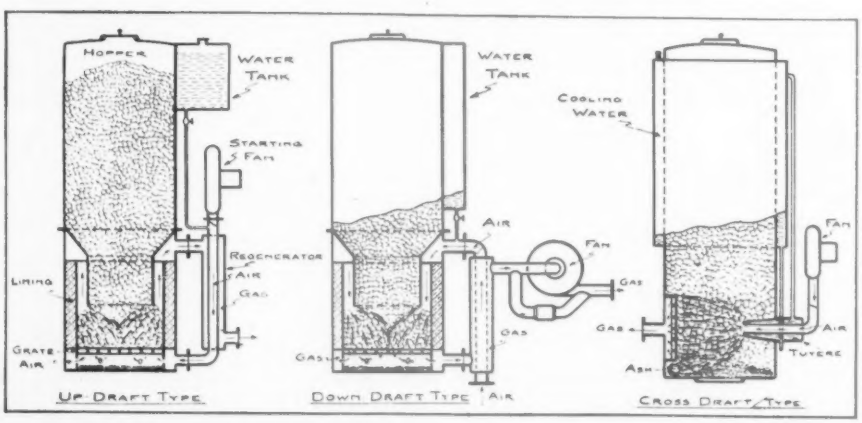


Fig. 1—Diagrams of the 3 principal types of gas producers for motor vehicles

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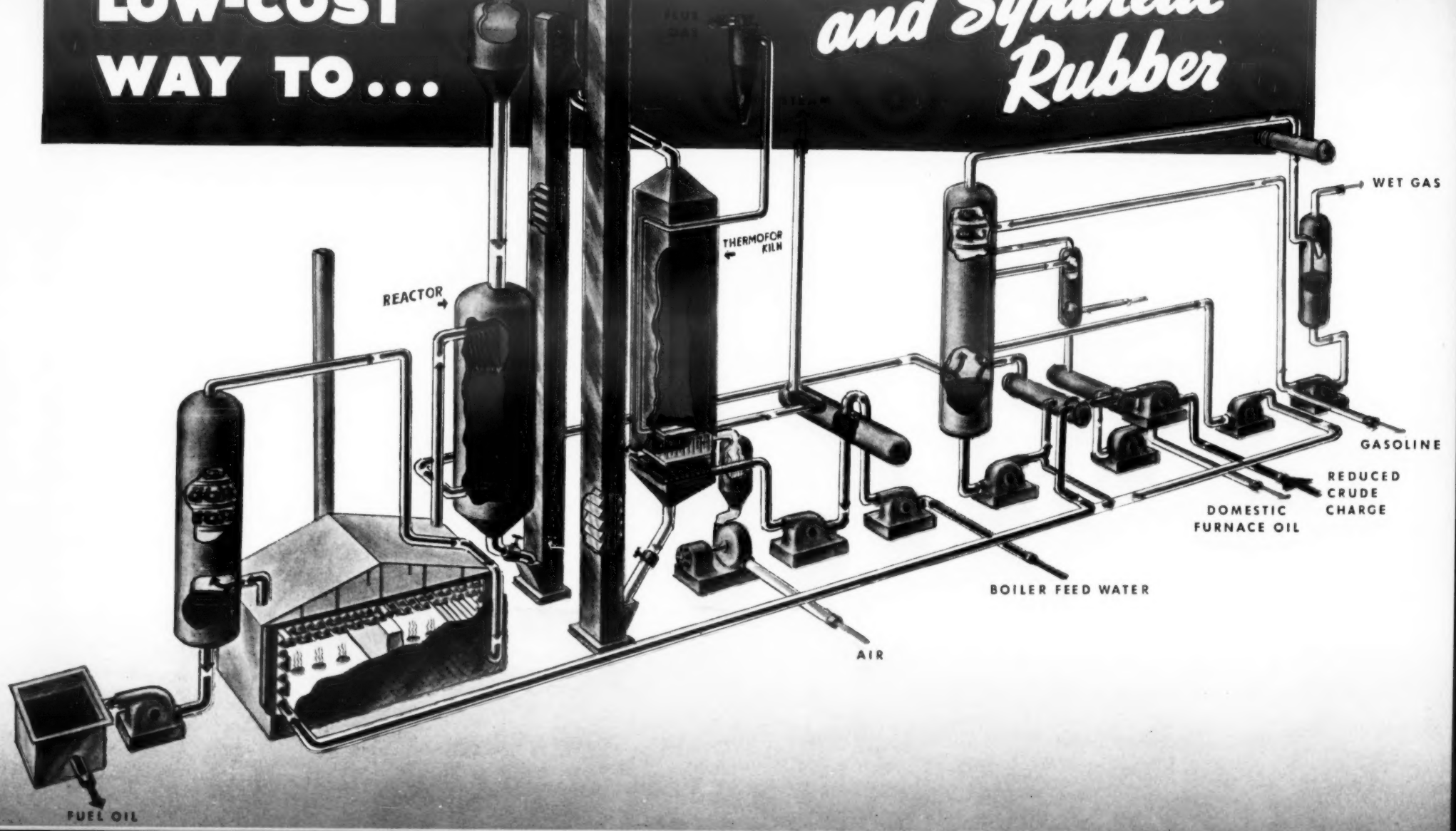

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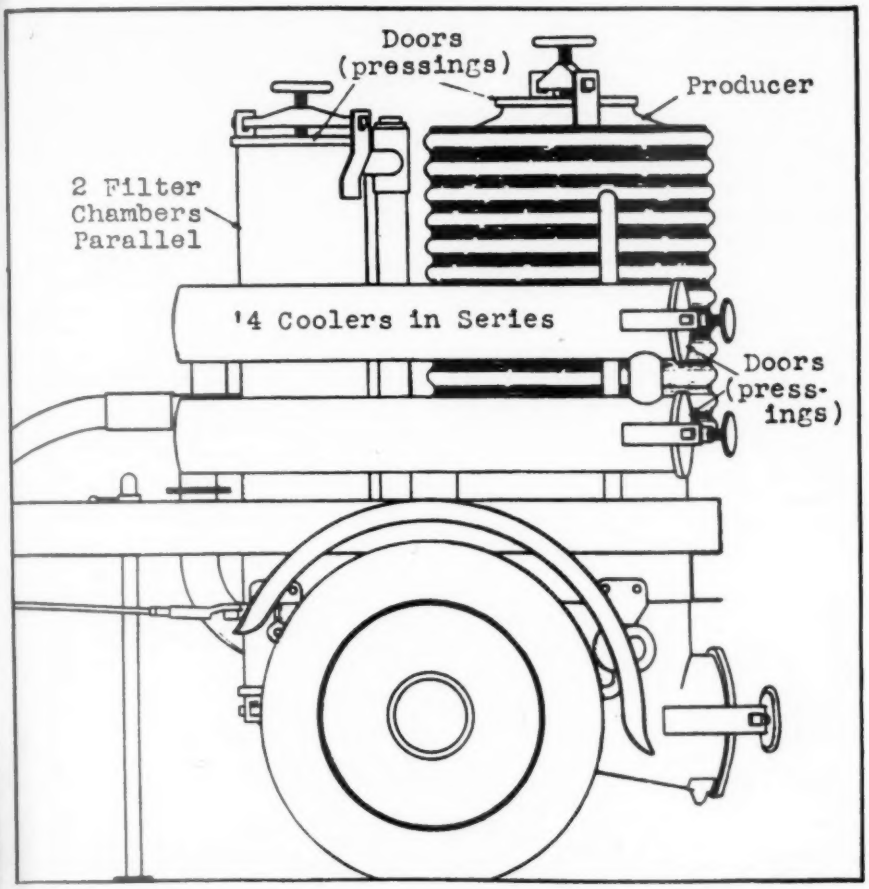


Fig. 2—Diagram of type of gas producer equipment recommended for motor vehicles by British authorities, mounted on a specially designed trailer

Doors made from mild steel pressings are fitted for cleaning.

"In the model shown (Fig. 2) the cooled gas passes through a filtering unit consisting of two vertical cylinders, fitted with doors which are interchangeable with those on the producer. The filter is so arranged that the gas passes in parallel through 4 beds of sisal tow which is used as a filtering medium . . . From the filter the gas is led through a quickly detachable flexible coupling to a pipe on the lorry leading to the engine."

Mounted on Trailer

The Emergency Producer for Great Britain was designed to be fitted directly to the vehicle, or mounted on a trailer. It was believed that, in an emergency, the easiest form of conversion was likely to be by means of a trailer and the special trailer unit shown in Fig. 2 was designed for this purpose.

Other types of gas producers used include double-draught and double-zone producers. The double-draught type works on the principle of the upper part of a bed of fuel burning downward and causing volatile matter to be driven off so that the volatile matter then passes through the upper incandescent zone of the lower up-draught part of the fuel bed to cause complete decomposition. In double zone producers two fuel beds may be employed; these are arranged one within the other and separate fuel feeds are provided for each bed. The air supply may be downward only through the outer bed, so that the hot gases then pass upward through the inner fuel zone. Alternately, two air feeds may be employed.

Material used in gas producers and auxiliary equipment is mostly sheet metal. Hoppers, coolers and filters are usually galvanized or painted to lessen corrosion. Grates and tuyeres are made of alloys to resist heat, high temperature and oxidation. The producer or generator is lined with a refractory such as carborundum, magnesite, bauxite or fire clay. On trucks the generator is generally mounted near the front, at either side or just back of the cab. On busses and pleasure cars it is in the rear and may be carried on a small two-wheel trailer. Coolers are ordinarily placed underneath the vehicle, also the filter if it is the horizontal type. A final filter, if used, is located near the intake manifold.

Operation

It is customary to start on gasoline, when the engine is cold and to use this operation as an exhauster to draw the flame through the fuel bed in the gas producer from a torch inserted in the mouth of the tuyere. Ignition of the fuel takes place in about one minute, and the complete starting operation from the time of inserting the torch to the time when the vehicle moves off on producer gas, is said by the English authorities to take from 2 to 4 minutes. A Russian report, however, states that from 10 to 12 minutes are necessary for this operation. Full power it is said is developed in about 20 minutes, during which time adjustment of the air control valve may be necessary. After that, however, performance is said to become steady.

As fuel is consumed its level falls in the hopper and it becomes necessary to refuel the producer after a period depending on the size of the vehicle and nature of the service. Fuel consumption of a vehicle with a gross laden weight of about 6 tons is normally from 1.5 to 2 lbs. per mile, it is said. In such cases, 120-150 miles may be covered on a single charge of anthracite, and less distance on more bulky fuels such as low-temperature coke. Recharging is carried out at the side of the road from sacks carried on the vehicle. Removal of ash and clinker is usually not necessary until after the day's run.

In starting up after a short stop it is desirable to keep the engine idling, while the vehicle is stopped, to maintain the fuel bed in good condition. If the engine is stopped for an hour or more, it is usually necessary to start on gasoline and to "draw up" the fire before changing over to producer gas.

Cylinder Wear a Danger

The most likely cause of engine damage where producer gas is used is said to be cylinder wear caused by abrasion arising from bad filtration of the gas due to carelessness in the fitting or maintenance of the filters.

"Solid fuels are extremely varied substances and their conversion into gas is a complex reaction," states the Egloff-Van Arsdell paper. "However, the thermochemical changes can be shown in the following briefly summarized equations:

$$\text{“ } CO_2 + C \longrightarrow 2\,CO - 38{,}800 \text{ Cals.}$$
$$2C + O_2 \longrightarrow 2\,CO + 58{,}800 \text{ Cals.}$$
$$C + O_2 \longrightarrow CO_2 + 97{,}650 \text{ Cals.}$$
$$2CO + O_2 \longrightarrow 2\,CO_2 + 136{,}400 \text{ Cals.}$$

"Where water is used, or where there is considerable moisture from the fuel drawn into the fire bed:

$$H_2O + C \longrightarrow CO + H_2 - 28{,}800 \text{ Cals.}$$
$$H_2O + CO \longrightarrow H_2 + CO_2 + 9{,}400 \text{ Cals.}$$
$$C + 2H_2O \longrightarrow CO_2 + 2H_2 - 18{,}800 \text{ Cals.}$$

"Some types of gas generators now marketed are making use of the higher calorific power obtainable from gas that has had water added during combustion of the fuel, since by the use of water in fuel beds attaining a high enough tem-

perature, a water-gas mixture rather than carbon monoxide alone is the product. However, upon a long idling of an engine, the temperature of the fuel may decrease sufficiently to prevent the decomposition of water on contact so that it will pass through as steam and be condensed in the cooling and cleaning coils of the producer, giving rise to difficulty in operation."

The approximate composition of producer gases derived from wood and charcoal are shown in Table 3.

Table 3

(Approximate Composition of Producer Gases Derived from Wood and Charcoal)
(Average Per Cent)

	Wood		Charcoal	
Carbon monoxide	20°	20°	30°	28°
Carbon dioxide	11	8	2	5
Hydrogen	17	12	10	3
Hydrocarbons	2	2	0- 2	2
Nitrogen	50	58	56-58	62

°Data in the first column is from English authorities, that in the second column from Russian sources.

The calorific values of a number of fuels used in producer gas generators are given in Table 4.

Table 4

Calorific Values of Producer Gas Fuels

Fuel	B.T.U.'s per Lb. (Approx.)
Charcoals	13,428
Anthracite Coal	14,800
High-temperature Coke (unactivated)	13,200
High-temperature Coke (activated)	13,420
Low-temperature Coke (externally heated retort)	14,200
Low-temperature Coke (internally heated retort)	13,224
Brown coal (char)	12,040
Peat (charcoal briquet)	12,800
Gasoline (60 A.P.I. gravity)	20,250

The average weight of solid fuels used for producer gas production is over twice that for gasoline, as shown in Table 5.

Table 5

(Average Weight of Producer Gas Solid Fuels)
(One gallon of gasoline, 6.2 lbs. equivalent to pounds of solid fuel)

	Lbs.
Wood	20.0
Wheat	20.0
Anthracite	15.0
Charcoal	12.5
Coal	12.0

The increase in the weight of the motor vehicle with producer gas equipment ranges from 360 to over 1000 pounds, compared to the vehicle when gasoline is used.

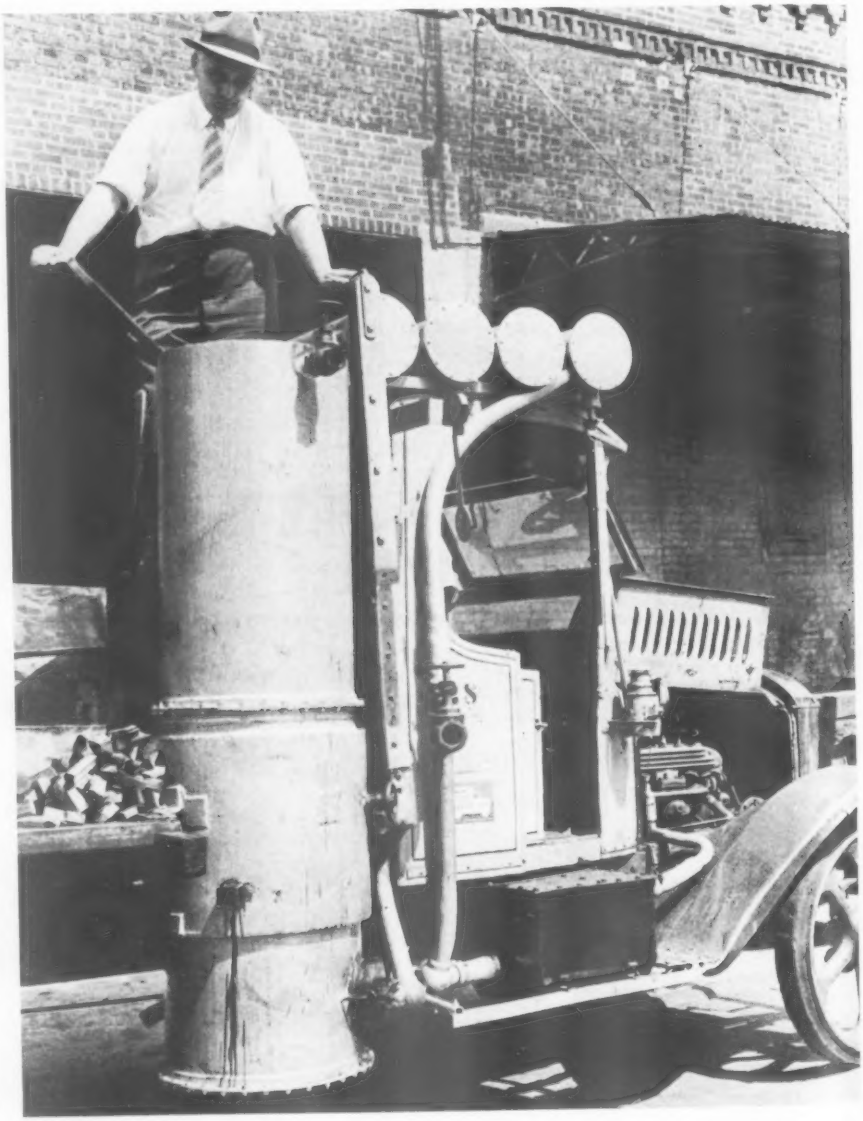
Compression Ratios

On the question of compression ratios on producer gas vehicles the paper states:

"The compression ratios on the producer gas vehicles vary from about 4.7 to 1 for the converted automobile engine without special cylinder heads, to about 14:1 for those fitted to handle the gas. Ratios as high as 16.2 have been tried with fairly successful results; but for engines which must be changed over from gasoline to producer gas when starting, the ratios from 6.5:1 to 9:1 are more satisfactory, and even the 9:1 is on the high side.

"For those engines having higher than 10:1 ratios, special cylinder heads are necessary; and for the 14:1 to 16.2:1 ratios, the design of the piston and cylinder head are of especial importance. As the ratios increase, the efficiency as compared to gasoline also increases. For the engines using producer gas without any change in the engine, the efficiency of the producer gas as compared to gasoline is about 50%. For the highest compression ratio, 16.2:1, the efficiency as compared to gasoline is between 75 and 80%".

In 1938 about 9000 gasogene busses and trucks were operated in Europe and only a few on any other continent. In 1941 it is estimated about 450,000 vehicles were in operation; by 1942 approximately 815,000 were in use, not only as land vehicles, but also as river boats, barges and stationary engines. In the U.S. there are so far only a very few producer gas propelled vehicles operating experimentally on wood or charcoal.



Said to be the first truck in New York City operating on producer gas because of rationing of gasoline. Wood in small pieces of the size shown is fed into the cylindrical generator. The gas passes through cleaning and cooling tanks on top of the cab, then down the pipe and through a filter to the manifold

Practical Design of Foundations For Vertical and Horizontal Vessels*

By J. A. Shjarback**

Among the factors to be taken into account in the proper designing of foundations for towers, absorbers and other refinery vessels are atmospheric, climatic and soil conditions. The design of footings for both horizontal and vertical vessels is presented, including foundations for elevated vertical vessels. Calculations for footings sizes are given.

There are many problems that should be settled before the design engineer can proceed with a design problem for a refinery unit. It is very erroneous to give the design engineer information on soil bearing value without a thorough investigation. Atmospheric and climatic conditions must be taken into account, as well as wind pressure and seismic forces. Accurate information concerning strength of concrete, building code to be used and specifications by the owner should be provided. A preliminary layout showing location of all equipment is essential. Information concerning height of equipment and type of material to be used in frames and buildings must also be available.

Soil Bearing

Soil investigation should be placed in the hands of a competent soil mechanic engineer. From his information, it is possible to arrive at a safe soil pressure for any depth. His information tells for any size footing the amount of soil pressure to use to get the same amount of deflection throughout the site. (See Table 1). Using variable soil pressures for different size footings, therefore, is not practical. It is common engineering practice to use the soil pressure for the average size footing on the site given in Col. 4 of Table 1.

Generally, by taking a certain number of borings at random throughout the site, it is possible to find out whether the strata are parallel or sloping. It is possible that the first layer of strata would take only a very light safe load, while the second layer of strata would take a much heavier safe load. This would give the design engineer some indication as to depth of footing. All this information should be given to the design engineer in order to prevent costly mistakes based on wrong assumptions.

It would be well to know the atmospheric and climatic condition at the site where the refinery is to be constructed. It is not necessary to consider tornadoes, hurricanes or wind storms. The U. S. Weather Bureau has over 100 stations throughout the U. S. with a possible record of over 50 years at each station. From any locality it is possible to get the maximum wind pressure in pounds per square foot. It is well to know beforehand whether to use the full wind pressure on the projected area or to make a reduction due to curved surfaces. Wind load on all piping, platforms, and all other projections from the vessel must be considered. Seismic force should be definitely stated. Most commonly used factors are 0.1G and 0.2G.

The scope of this paper will be limited almost entirely to the discussion of designing foundations for vertical and horizontal vessels.

Vertical Vessels (Self Supporting)

Simple Footings

Vertical vessels are subject to 3 conditions, empty, operating or full. With vessel empty, or operating, either wind force or seismic force has to be considered. With vessel full or test condition, no wind force or seismic force need be considered. The footing should be designed for the maximum allowable soil pressure for the above conditions. With wind or seismic forces, all allowable stresses may be increased 33-1/3%. The soil pressure, however, may not be so increased unless the soil mechanic engineer has so stipulated. Under full or test conditions there should be no such increase. To get the maximum allowable soil pressure for wind or seismic force, and still not have compression under the entire footing, the stability ratio must be satisfied, otherwise the soil pressure has to be reduced by increasing the size of the footing.

Combined Footings

To support two or more vessels the footing should be designed for various combinations of loading with no wind force or seismic force and with vessels empty and others full or test condition. When considering wind force or seismic force all vessels should be empty or operating. The center of gravity of the vertical loads and the center of gravity of the footing should coincide for operating conditions, giving a uniform soil pressure throughout. The stability ratio must be satisfied for a combined footing the same as for a simple footing. Otherwise the maximum soil pressure will govern.

Footing for Elevated Vessel

Sometimes vertical vessels are elevated for some process reason. In this case either a reinforced concrete or steel frame of rigid type is designed. This type of structure with footing must satisfy all the conditions as required for a simple footing.

Design of Simple Octagonal Footing for a Vertical Vessel.

All information concerning the weight of vessel (empty, operating, or full), and weight of such incidentals as piping, platforms, insulation, etc. should be known. It is necessary also to have all data on depth of footing, soil pressure, wind load, seismic force, and the maximum allowable concrete and steel stresses.

Design of Anchor Bolts

An allowable stress of not less than 12,000 p.s.i. and not more than 15,000 p.s.i. should be used for the bolt; and bolt sizes ranging between 1 in. minimum to 2½ in. maximum should be used. This range in allowable stresses facilitates the selection of the correct size bolt for the minimum or maximum circumferential bolt spacing. This low stress also allows for any corrosion. No allowance for reduction in initial tension need be made. The initial tension must be overcome by the stress due to wind or seismic force before the bolt will take any additional stress. For example, let us assume the initial tension due to tightening the bolt developed 15,000

Table 1

Example of Load Settlement Relations for Spread Footings

Minimum Width Feet	Safe Load Tons per Sq. Ft.	Settlement for Safe Load Inches	Safe Load for 0.5-in. Settlement Tons per Sq. Ft.
2	4.5	0.47	4.5
3	5.0	0.57	4.4
5	6.5	0.83	4.0*
7	8.0	1.17	3.5
10	10.0	1.74	2.5
25	26.0	8.34	1.0

* Soil pressure to be used.

* Presented before California Natural Gasoline Assn., Los Angeles, Sept. 2, 1943.

** Refinery Division, Fluor Corp., Ltd., Los Angeles.

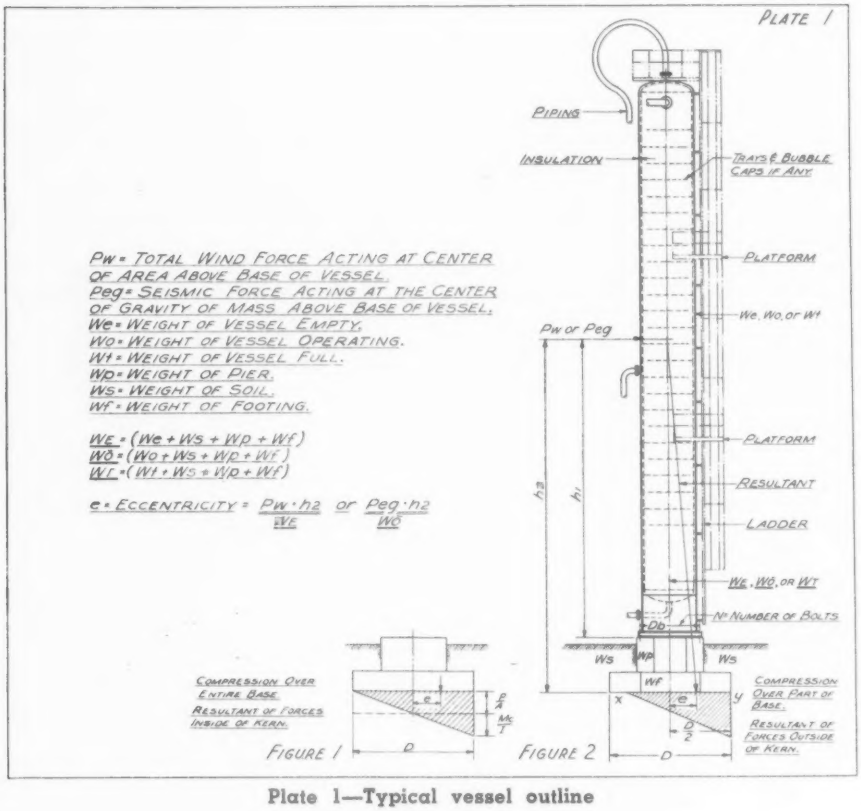


PLATE 1
PIPING
INSULATION
TRAYS & BUBBLE CAPS IF ANY
PLATFORM
We, Wo, or Wt
Pw or Peg
PLATFORM
RESULTANT
LADDER
We, Wo, or Wt
No. NUMBER OF BOLTS
Db
Ws
Wp
Ws
Wf
Pw = TOTAL WIND FORCE ACTING AT CENTER OF AREA ABOVE BASE OF VESSEL.
Peg = SEISMIC FORCE ACTING AT THE CENTER OF GRAVITY OF MASS ABOVE BASE OF VESSEL.
We = WEIGHT OF VESSEL EMPTY.
Wo = WEIGHT OF VESSEL OPERATING.
Wt = WEIGHT OF VESSEL FULL.
Wp = WEIGHT OF PIER.
Ws = WEIGHT OF SOIL.
Wf = WEIGHT OF FOOTING.
We = (We + Ws + Wp + Wf)
Wo = (Wo + Ws + Wp + Wf)
Wt = (Wt + Ws + Wp + Wf)
e = ECCENTRICITY = Pw·h2 / We or Peg·h2 / Wo
COMPRESSION OVER ENTIRE BASE
RESULTANT OF FORCES INSIDE OF KERN
COMPRESSION OVER PART OF BASE
RESULTANT OF FORCES OUTSIDE OF KERN
FIGURE 1
FIGURE 2

Plate 1—Typical vessel outline

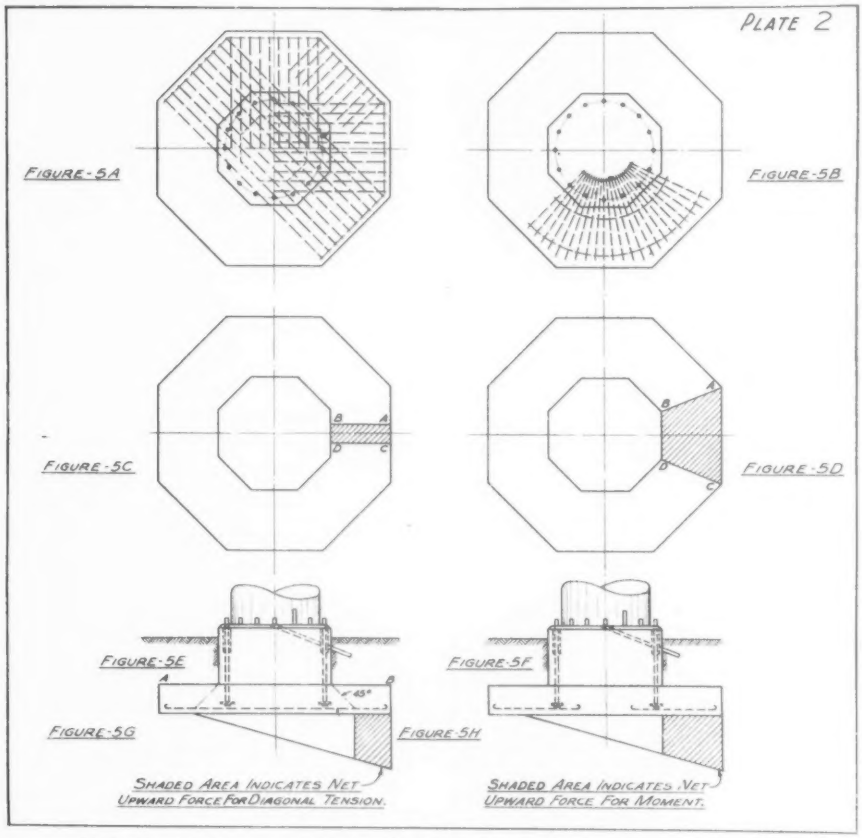


Plate 2—Design and detail sketches for typical octagonal footings

p.s.i. and suppose the stress in the bolt due to overturning moment developed 15,000 p.s.i. So long as the initial tension has not been overcome, plus the weight of vessel, the maximum stress in the bolt will still be only 15,000 p.s.i.

Wind moment or seismic moment for the design of bolts (See Plate 1, Fig. 2); Moment at base of vessel, M=(PW or Peg)hi.

Assuming the neutral axis is always on the center line of bolt circle, the following is the general formula for the maximum stress per bolt, $\frac{P}{A} \pm \frac{Mc}{I}$. (Plate 1, Fig. 1). As we are interested only in the tension stress in the bolt, this formula becomes $\frac{Mc}{I} - \frac{P}{A}$. For wind and empty vessel this form changes to $\frac{4(PW \times hi)}{N \times Db} - \frac{WE}{N}$ and for seismic and operating vessel the form changes to $\frac{4(Peg \times hi)}{N \times Db} - \frac{Wo}{N} = .$ Whichever is maximum will give the stress per bolt.

Design for Footing Size

(a) Ordinarily under ideal conditions we would design a footing of octagonal shape, but in approximately 50% of the cases this is not possible, due to other equipment adjacent to the vessel which might warrant a square or rectangular foundation. We will assume, however, that we are in this case designing an octagonal footing.

(b) First assume size of octagonal pier and the size of octagonal footing. The pier in most cases is assumed to be 18 in. larger than the diameter of the vessel. It is possible in estimating the size of the footing, that you may have to make two or three assumptions before you have the right size for all the conditions involved.

The footing has to be designed for the maximum condition, that is having a maximum soil pressure and a minimum stability ratio.

To satisfy the design three cases would be necessary:

Case I; vessel empty with wind or seismic, whichever is greater.

Case II; vessel operating with wind or seismic, whichever is greater.

Case III; vessel full or test condition with no wind or seismic force.

To find moment at base of footing for both wind and seismic force. (Plate 1, Fig. 2):

Wind Moment = Pw·h2
Seismic Moment = Peg·h2

In Case III you have satisfied the condition when the soil pressure does not exceed the maximum allowable. In Cases I and II you have satisfied all conditions when the soil pressure has not been exceeded, and the stability ratio is not less than the stability ratio specified. This stability ratio is as follows:

$$\frac{\text{Resisting Moment (WE or WO) D/2}}{\text{Overturning Moment (Pw or Peg)H}_2} \text{ or}$$

With a maximum allowable soil pressure and the stability ratio as specified the resultant may fall outside of the Kern Section, therefore not giving compres-

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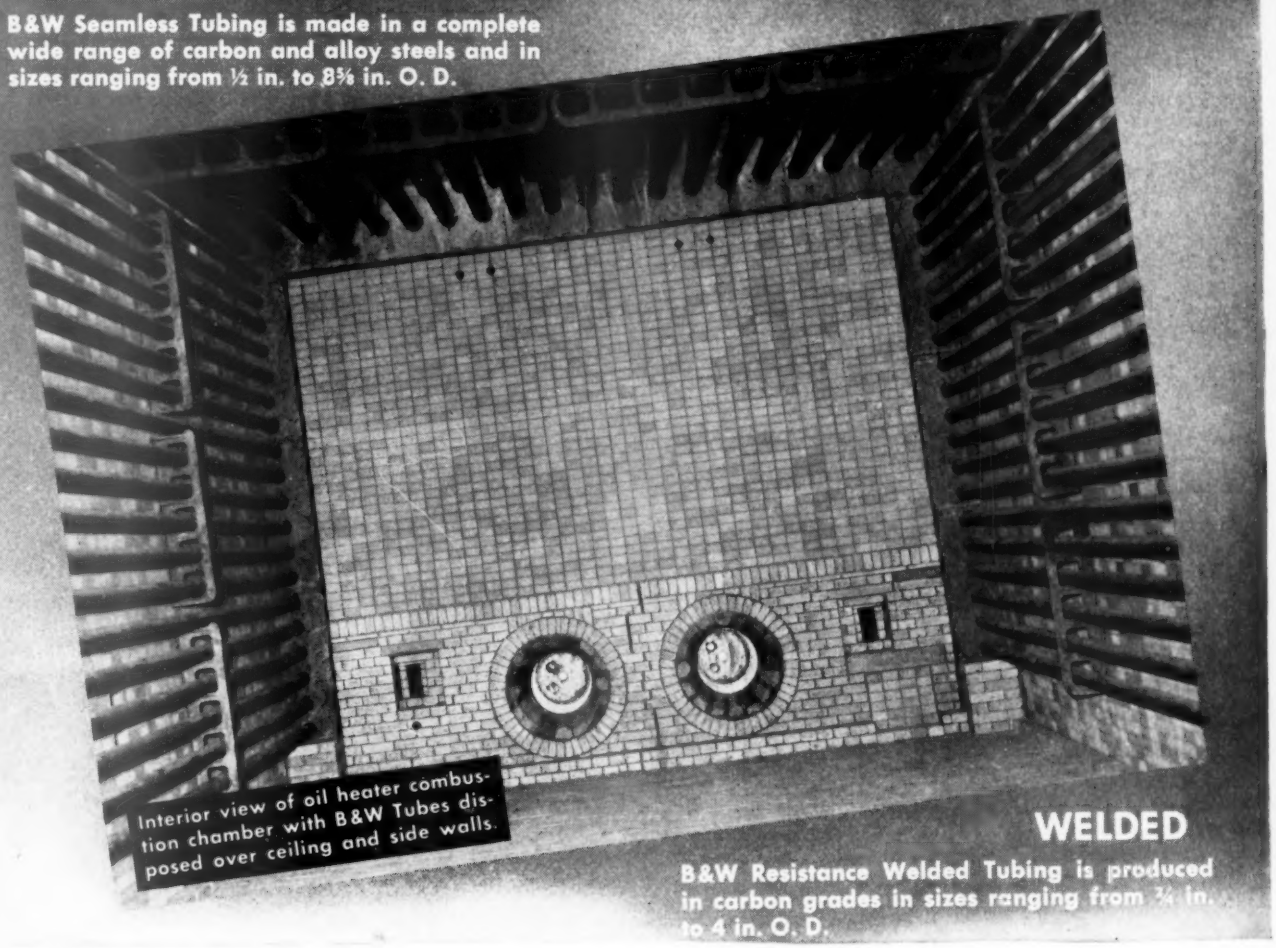

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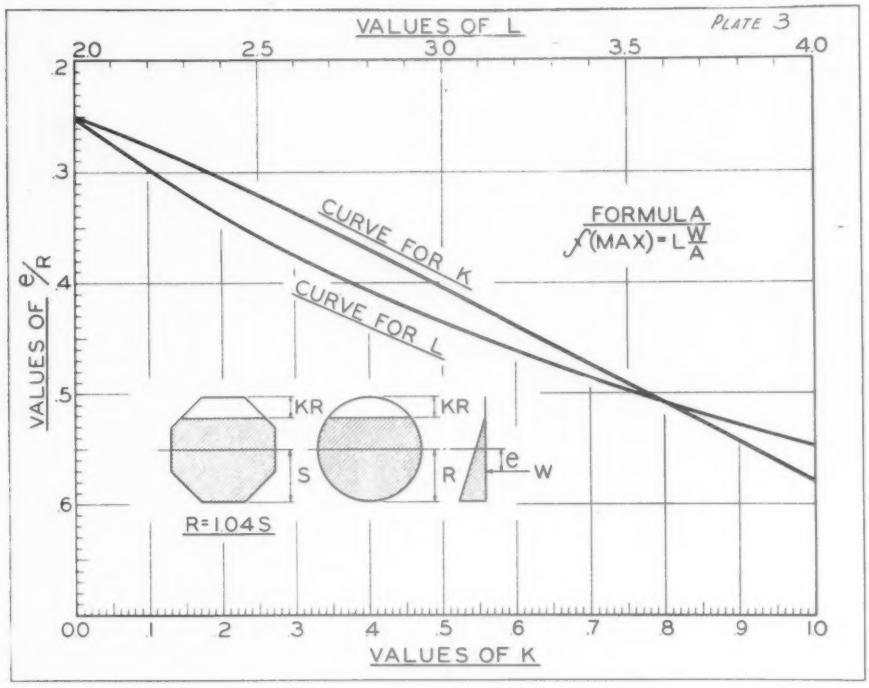


Plate 3—Foundation pressures, round and octagonal bases, values of K and L

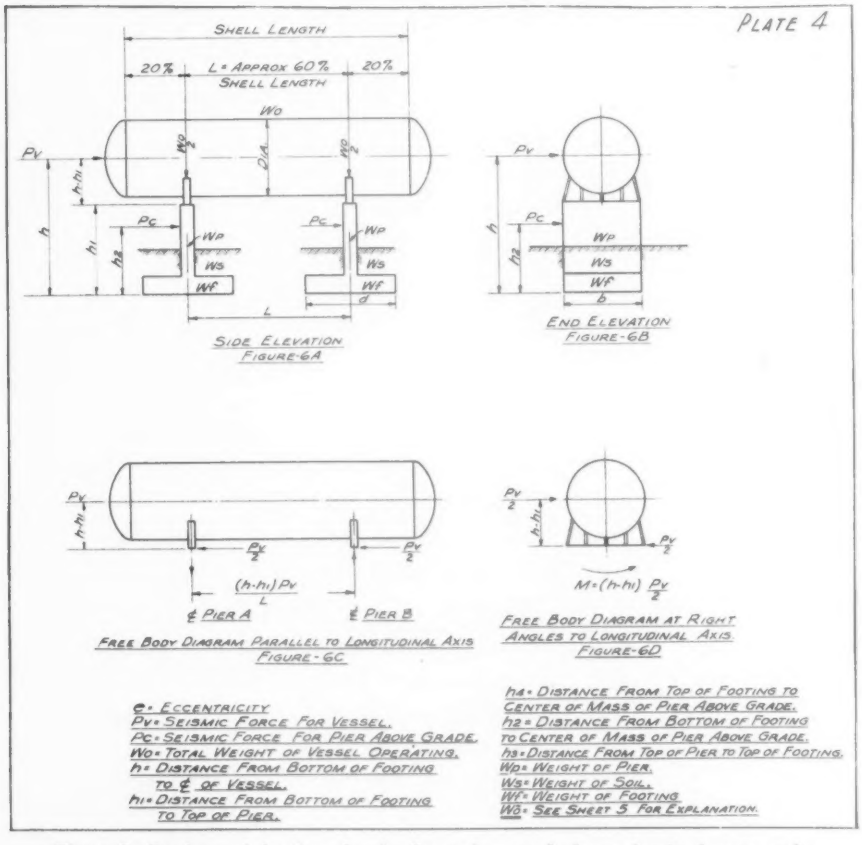


PLATE 4
SHELL LENGTH
20%
L = APPROX 60% SHELL LENGTH
20%
Wo
Pv
Pc
Wp
Ws
Wf
SIDE ELEVATION
FIGURE-6A
END ELEVATION
FIGURE-6B
FREE BODY DIAGRAM PARALLEL TO LONGITUDINAL AXIS
FIGURE-6C
FREE BODY DIAGRAM AT RIGHT ANGLES TO LONGITUDINAL AXIS
FIGURE-6D
e = ECCENTRICITY
Pv = SEISMIC FORCE FOR VESSEL.
Pc = SEISMIC FORCE FOR PIER ABOVE GRADE.
Wo = TOTAL WEIGHT OF VESSEL OPERATING.
h = DISTANCE FROM BOTTOM OF FOOTING TO ℄ OF VESSEL.
h1 = DISTANCE FROM BOTTOM OF FOOTING TO TOP OF PIER.
h4 = DISTANCE FROM TOP OF FOOTING TO CENTER OF MASS OF PIER ABOVE GRADE.
h2 = DISTANCE FROM BOTTOM OF FOOTING TO CENTER OF MASS OF PIER ABOVE GRADE.
h3 = DISTANCE FROM TOP OF PIER TO TOP OF FOOTING.
Wp = WEIGHT OF PIER.
Ws = WEIGHT OF SOIL.
Wf = WEIGHT OF FOOTING
Wo = SEE SHEET 5 FOR EXPLANATION.

Plate 4—Design of footing for horizontal vessel, for seismic forces only

sion under the entire footing. However, it seems a wasteful practice to design the footing especially for the unusual circumstances of an earthquake or tornado which may occur once in the life time of the structure. It is not necessary to have compression all over the base as long as the stability ratio is that specified. With compression under the entire footing the general formula $\frac{P}{A} \pm \frac{Mc}{I}$ is correct. $\frac{P}{A}$ is always as large or larger than $\frac{Mc}{I}$. (See Plate 1, Fig. 1). With compression over part of the footing and since there can be no tension between the concrete and earth, the general formula $\frac{P}{A} \pm \frac{Mc}{I}$ would not satisfy this condition. (See Plate 1, Fig. 2). A curve has been developed by Hool & Kinne, one for a square base with wind or seismic perpendicular to side, one for wind or seismic parallel to diagonal, and another for a round footing. With a few changes the curve for a round footing can be used for an octagonal footing. (See Plate 3). The computations are fairly simple for a square footing with wind perpendicular to the side. (See Plate 5, Fig. 7B).

$\frac{P}{A} \pm \frac{Mc}{I}$ is not true in this case. The maximum soil pressure p.s.i. $= \frac{2\,Wo}{3\,(d-e)\frac{b}{2}}$

Wo = Total Vertical Load
e = Eccentricity
b = Width of footing

This condition becomes a little more difficult for footings other than square or rectangular.

All allowable stresses in footings are generally increased 33-1/3% for wind or seismic forces. For test condition the allowable stresses should not be exceeded.

Method of Reinforcing Octagonal Footing

The method of reinforcing the base should be given some consideration. Figs. 5A and 5B, Plate 2 show four-way reinforcing and radial reinforcing. For large footings there is a saving of approximately 25% in steel in favor of radial reinforcing. The radial reinforcing is limited to the size of the footing. In case the pier is small there would be overlapping of reinforcing bars, which would make it too congested to be practical. The pier should be large enough so that it would be possible to extend the bars in from the face of the pier to develop bond and still have clearance between the bars for the aggregate. The depth of the footing for the radial reinforcing would be greater than for the four-way. In Fig. 5C the shaded area indicates the area used for the moment for the four-way as against the shaded area in Fig. 5D for the moment for the radial reinforcing. By inspection you will note that there is a greater force at Fig. 5D for the width B-D than at Fig. 5C for its width B-D, therefore the radial reinforcing requires a larger d (effective depth) for the same K value. There would be some gain for the radial reinforcing due to the fact that there is a 3 in. clearance between the earth and

the underside of reinforcing bar. If, however, four-way reinforcing is used, approximately 2 in. more for the total depth should be deducted.

Figs. 5E and 5F of Plate 2 indicate bottom reinforcing. In my opinion top reinforcing should be eliminated especially during the war crisis. A substantial saving of steel can be made by using the National Emergency Specification of the War Production Board. By making the depth of footing large enough so that the concrete does not exceed the allowable tensile value the top steel can be eliminated. The tensile value of concrete is 0.04fc according to the emergency specification, with an allowable increase of 33-1/3% for wind or seismic forces.

At Point A of Fig. 5E there will be no soil pressure with wind or seismic force acting, but the footing will have to be designed for a moment to take care of the weight of footing plus the weight of earth. In Fig. 5G the shaded area indicates the upward force in the critical section for diagonal shear. In Fig. 5H, the shaded area indicates the upward force for moment.

In some cases it is possible to design the pier or pedestal on a footing with a hollow center. This hollow space is later filled with earth on which is placed a concrete slab. If the pier and pedestals are made hollow, the supporting wall that forms the octagon should not be less than 18 in. thick. Obviously an octagon less than 8 ft., 0 in. O.D. would not be practical as there would not be room for men to construct forms. Furthermore, in order to make this type of construction practical the depth would have to be at least 6 ft. Otherwise the cost of form work would be greater than the saving of concrete. This type of construction necessitates more reinforcing in walls. The moment at the center of footing should be checked for a positive or negative when the hollow pier or pedestal is used.

Footings for all horizontal vessels should be limited to 2. The footing should be so spread that the stress at the center of vessel is the same as over the center of support. The footing should be set in a distance from the head seam approximately 19% of total length of shell. This would give approximately 62% of shell length between supports. Approximately 20% or more of the inside upper surface may be in contact with vapors, whereas the lower surface will be in contact with liquids. Since vapors are poorer thermal conductors than liquids, the sun's rays cause the dry surfaces to become hotter than the wet ones. This variation in temperature tends to deflect or curve vessel at center, thus lifting off intermediate supports if

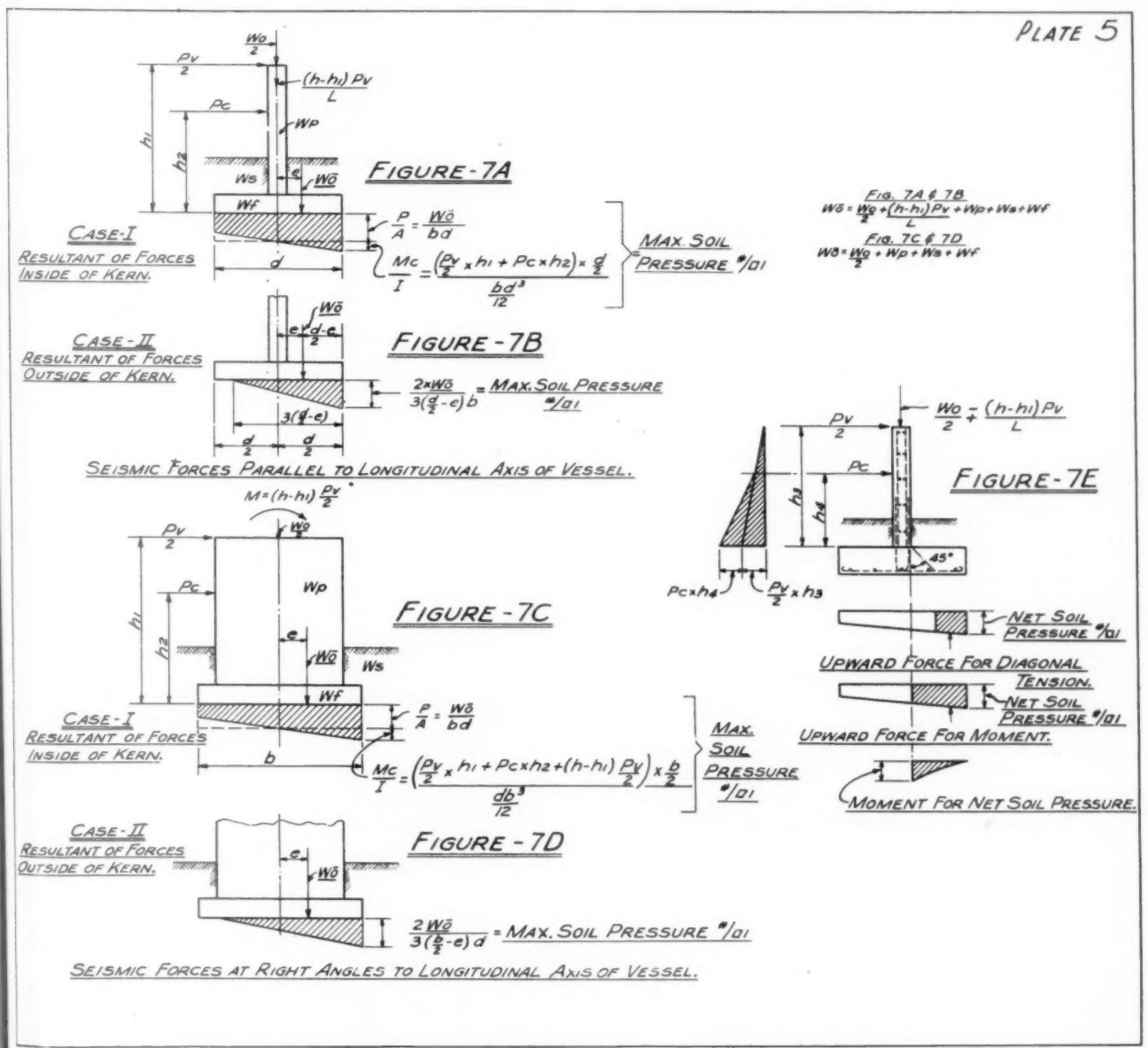
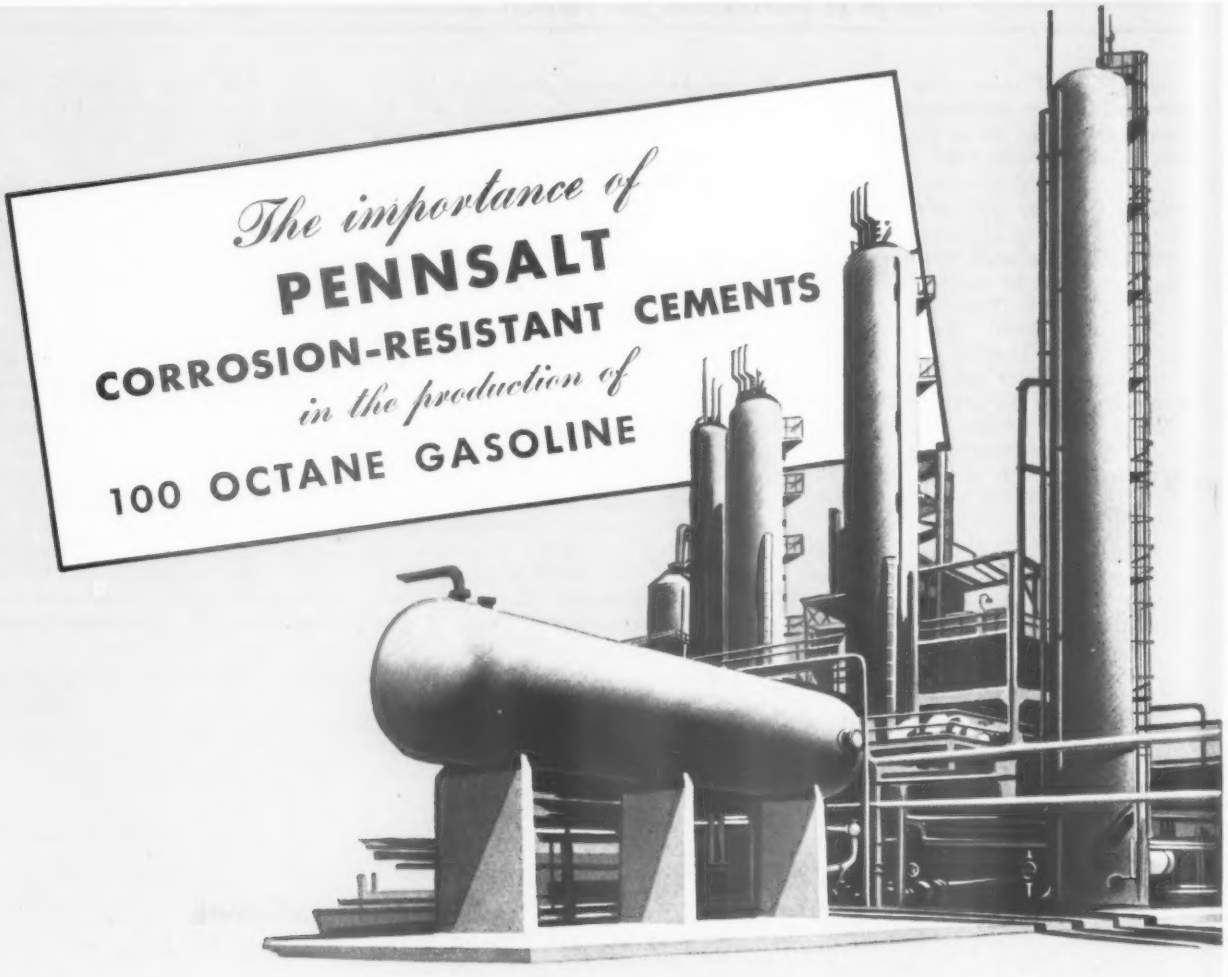


Plate 5—Typical design of footing for horizontal vessels



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there are more than two supports. If the vessel lifts off intermediate supports, naturally the end supports would take additional load, thereby increasing the soil pressure.

Expansion of horizontal vessels should also have some consideration. Many vessels operate under high temperatures. When the expansion is small there is no reason to provide for a roller. Generally a slide plate is provided at the free end. Where a roller is provided, the fixed end pier would have to be designed for the total seismic force parallel to longitudinal axis.

Placing both piers on one combined footing is more expensive than designing an individual footing for each pier. For combined footing it would be necessary to have both top and bottom reinforcing to take care of the moments. In a single footing reinforcing is only necessary at the bottom of slab.

Design of Footing for Horizontal Vessel

Fig. 6A, Plate 4 shows all the forces acting on Pier A and Pier B parallel to longitudinal axis.

Fig. 6B, Plate 4 shows all the forces on Pier A or Pier B, at right angle to longitudinal axis.

Fig. 6C, Plate 4 shows a free body diagram of seismic forces on vessel parallel to longitudinal axis.

Fig. 6D, Plate 4 shows a free body diagram of seismic forces on vessel right angle to longitudinal axis.

Fig. 7A, Plate 5 shows all the forces acting on Pier B, shown in Plate 4, parallel to longitudinal axis and the resultant soil pressure. Case I and II for Fig. 7A and 7B are self-explanatory. Case I is when the resultant force comes inside the Kern. Case II is when the resultant comes outside the Kern and still has a stability ratio as specified.

Fig. 7C, Plate 5 shows all forces acting on Pier B at right angles to longitudinal axis. Case I and Case II for Fig. 7C and 7D is similar to Case I and II of Figs. 7A and 7B.

The footing should be designed for maximum soil pressure for either Fig. 7A or Fig. 7C.

In Fig. 7E, shaded area indicates total net soil pressure or vertical upward force which produces Diagonal Tension Stresses. Other shaded areas in the same figure indicate total net upward soil pressure which produces moment in the footing. At bottom of Fig. 7E is shown moment to design bottom slab.

To the right of Fig. 7E is shown total moment at base of pier. Pier should be designed for direct vertical load plus moment. This design would be the same as for a reinforced concrete column using a 1 ft., 0 in. strip for the width. Fig. 7E shows typical method of reinforcing this type of footing.

Trend is Toward Functional Tests for Lubricants*

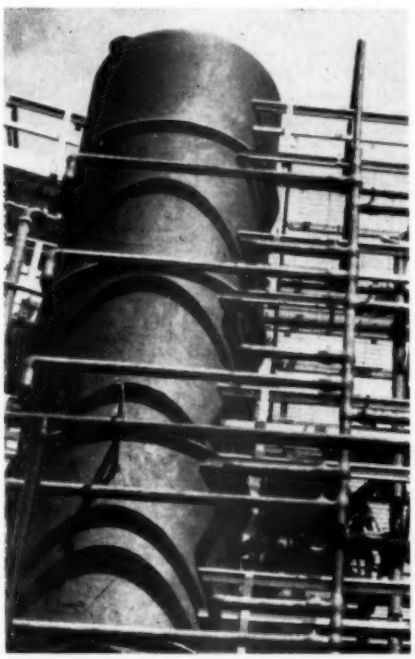
By F. W. Kavanagh**

The importance of evaluating new crudes and new processes for manufacturing lubricants in terms of the service characteristics of the resultant products is emphasized. Lubricant specifications are being made more functional and for exacting requirements products are being tailor-made, compounded from the most suitable stock and additive.

EVERY new type of engine and every new chassis design placed on the market has an influence on lubricant testing and on the types of product that are supplied. Also, new developments in crude sources and refining technique, as well as in organic chemistry, have an important influence on trends in lubrication, because they supply new materials from which improved lubricants can be made. In fact, one of the most important criteria of a new crude or new refining process is the performance characteristics of the resultant product and it is very desirable to evaluate all ramifications of a new manufacturing method in terms of the service characteristics of the product.

*Presented before Society of Automotive Engineers' Transportation and Maintenance Meeting, San Francisco, Aug. 20, 1943.

**Research Engineer, Standard Oil Co. of California.



Stripping column for recovering styrene not used in the polymerization reaction, at the new 120,000-ton-per-year capacity synthetic rubber plant at Port Neches, Tex.

Some of the current trends on lubrication may be outlined as follows:

1—Compounded oils are becoming more common. Oils containing compounding materials frequently have unusual properties not found in any uncompounded oils and in this respect, they may be considered as analogous to alloy steels. The use of compounded materials in lubricating oils is not new. For example, steam cylinder oils compounded with fats were used before 1900. Compounding materials to prevent brakeband chattering in Model "T" Fords were developed during the early 1920's.

Research work on compounded oils, however, did not become a major activity of the petroleum industry until the 1930's. During the decade from 1930 to 1940 special lubricants for high speed Diesel engines were developed and compounded automotive oils started to become popular. So much is known about compounded oils today that, when a difficult lubrication problem arises, the usual solution is to prepare a special, tailor-made product composed of the best oil stock and the most suitable compound.

2—Lubrication specifications are being made more functional. In the past these specifications contained such tests as gravity, flash point, viscosity, Conradson Carbon. It was found, however, that these tests were inadequate for indicating the quality of a compounded oil and many modern specifications contain test requirements very much like the service for which the products are intended. Examples of this are the Army 2104-B oils and the Navy 9000 series oils, both of which require a number of engine tests. Gear oil specification VV-L-761 required performance tests in an automotive hypoid differential. Many of the modern grease specifications limit the consistency of the product by means of special bearing tests rather than by the conventional penetrometer.

3—Lubricants for the military service are being simplified with respect to numbers of grades and types. It is believed that this trend is primarily a wartime measure to facilitate transportation of products to remote places and to eliminate improper fillings in the field. It is doubtful that this trend will have much effect on commercial applications.

4—Probably the most significant trend in lubrication is that of continuous and definite improvement in the quality of all products. This improvement has been continuous for a large number of years and there appears to be no reason to believe that such improvements will not continue. Therefore, even better lubricants can be expected in the future.

Kansas Oil Field Brines Analyzed For the Recovery of Magnesium*

THE PRACTICABILITY of extracting magnesium, an important wartime chemical, from oil field brines as an auxiliary phase of the oil producing industry is discussed in a special report of the State Geological Survey of Kansas, with the cooperation of many oil companies operating in that state.

An earlier report(1) by oil company authority on the commercial utilization of Oklahoma oil field brines concluded it was not practicable to process them to recover chlorides of calcium, magnesium and other compounds because of lower cost recovery methods utilizing other raw materials. This report, however, suggested the study of stronger brines in other districts of the country. Magnesium is known to be recovered commercially from oil field brines by Dow Chemical Co. at Midland, Mich., and is also said to be extracted from brines in West Texas.

In the investigation in Kansas, brine samples were collected from 79 oil pools in that state and analyzed in the laboratory of the state university. At least 6 oil-producing formations were found to have an average magnesium content greater than ordinary sea water, one present commercial source of metallic magnesium. The analyses bring out, the report shows, that the brines, irrespective of the oil field and producing structures from which they come, are essentially alike in the dissolved chemical constituents they contain. They differ materially, however, in the degree of concentration.

Below Sea Water Yield

Chloride, sodium and calcium greatly predominate among the chemical ingredients, with magnesium next in importance quantitatively. Table 1 lists these dissolved chemical constituents of Kansas oil field brines. Of all of them magnesium is classified as of the greatest importance, and also the only one which offers possibilities of commercial extraction under present conditions. While other ingredients such as sodium and calcium occur in far larger amounts, their extraction may be obtained much more readily from other sources.

In the investigation in the Kansas oil fields it was found that practically every oil-producing formation yields, in some well or wells, brines containing magnesium in greater amounts than are found in ordinary sea water. In most wells, however, the magnesium content was found to be much lower than that of sea water. The highest magnesium bearing brine was found in the Kansas City-Lansing zone, and this zone produced high magnesium content salt water in all wells and all fields. The Arbuckle limestone, on the other hand, while prevailingly low in magnesium, occasionally yields a brine high in content of this mineral. The analyses showed that certain formations are invariably higher in magnesium content than brines coming from others (Table 2). Not only is there a difference in the magnesium content of the brines of the various oil-producing formations, but there is also a quantitative variation of this constituent in any one formation, among the various oil fields and even from one part of a field to another.

Description Is Given

The following description of the derivation of metallic magnesium from oil field brines is given in the report of the Kansas State Geological Survey authorities:

"Natural brines contain sodium chloride, calcium chloride, magnesium chloride, bromine, and other chemical constituents. The first step in obtaining metal magnesium, Mg, is to treat the brine with calcium hydroxide (calcined limestone or quicklime, CaO, or with calcined dolomite, CaO and MgO). As a result, magnesium hydroxide, $Mg(OH)_2$, and calcium chloride, $CaCl_2$, are formed. The magnesium hydroxide is then dissolved in hydrochloric acid, HCl, to form magnesium chloride, $MgCl_2$, from which metallic magnesium and gaseous chlorine are derived by electrolysis. At the Dow Chemical Co.'s plant at Midland, Mich., the bromine is first removed from the brine after which the brine is treated with a magnesium hydrate slurry to precipitate iron and any other impurities contained therein. After the sodium chloride has been removed by crystallization, the magnesium and calcium chlorides in the rotary-filter mother liquor are separated from each other by fractional crystallization, with addition of chlorine during the process. The purified magnesium chloride solution is concentrated further by crystallization. The crystals are melted in their water of crystallization, the fused mass flaked, and then air-dried until an almost anhydrous magnesium chloride, $MgCl_2$, is produced. The magnesium chloride is then electrolyzed in a sodium chloride bath. The process is continuous, and the metal, which is of high purity, is periodically dipped from the rectangular cast-steel pots in which electrolysis occurs and cast into ingots of various sizes.

"Although metallic magnesium is the end product sought, it may not be desirable, feasible, or practicable to extract the metal from the oil field brines at each recovery plant established. It may prove to be more advantageous merely to produce magnesium hydroxide, $Mg(OH)_2$, dry it, and ship it elsewhere to be further processed. On the other hand, it may be desirable to further process the magnesium hydroxide to some specific magnesium product, such as 'caustic,' 'calcined,' or 'dead-burned' magnesia, and then dispose of the product. Or the process may be carried on to com-

TABLE I

(Dissolved Chemical Constituents of Kansas Oil Field Brines with Range in Milligrams per Liter)

Chemical Constituents	Range Milligrams Per Liter	Chemical Constituents	Range Milligrams Per Liter
Total solids	17,880-228,320	Bromide	0- 425
Chloride	10,729-142,547	Iodide	0- 8
Sodium	9,200- 68,700	Sulphate	0-2800
Calcium	246- 7900	Aluminum	0- 781
Magnesium	153- 3960	Iron	0- 15
Bicarbonate	12- 869		

TABLE II

(Magnesium Content of Brines from Kansas Oil Producing Formations†)

Formation	Magnesium in milligrams per liter: Range	Average
Layton		3,960
Stalnaker		2,620
Kansas City-Lansing	972-3,910	2,525
Hoover		2,515
Topeka		2,400
Peru	1,840-2,610	2,225
"Chat"	704-2,460	1,461
Bartlesville	461-2,490	1,223
"Conglomerate"	750-1,455	1,184
Simpson ("Wilcox")	235-2,035	1,033
"Mississippi lime"	432-1,857	772
Gorham	450-1,030	701
Viola	185-1,547	584
"Hunton"	153-1,138	523
Arbuckle	152-3,110	523

†For purpose of comparison the magnesium content of sea water is given in 3 recent investigations as 1045 milligrams per liter, 1279 and 1400 respectively.

*A review of "Kansas Oil Field Brines and their Magnesium Content", by Walter H. Schoewe, State Geological Survey of Kansas Bulletin 47, Part 2, July 30, 1943.

(1) "Recovery of Chemicals from Oil Field Brines Awaits Market for Chloride Compounds," Technical Section, NATIONAL PETROLEUM NEWS, June 2, 1943, pg. R-283.

pletion until metallic magnesium is obtained."

Limestone and dolomite, basic raw materials needed in the extraction of magnesium compounds from oil field brines, are available within convenient distance from Kansas oil fields. While at present there are no lime kilns operating in the state, calcined limestone or quicklime is manufactured at 6 Portland cement plants in eastern Kansas and it is suggested that quicklime plants might be established in the chalk area of western Kansas close to important oil fields. Sufficient cheap fuel, either natural gas or fuel oil, is available in most oil fields, or within easy reach.

Figuring Plant Costs

In calculating the actual cost of establishing a plant designed to process oil field brines for magnesium, the cost of the brine should not be charged against the recovery of magnesium, since the brine is a waste product pumped with the oil. The only legitimate cost so far as the brine is concerned, is for a pipeline to transport the brine from a number of leases to a central recovery plant. Where production of brine is not related to oil production, costs of drilling both brine well and disposal well would be included in recovery costs. In 1942 metallic magnesium sold at 22.5 cents per pound or $450 per ton; prices of other magnesium compounds are listed in Table 3.

Various general factors which affect the recovery of magnesium from oil field brines are discussed as follows in the report of the State Geological Survey of Kansas:

"The commercial practicability of recovering magnesium from oil field brines, aside from the cost of erecting and maintaining a recovery plant, is dependent upon several factors: (1) magnesium content of the brine, (2) amount of brine produced per well, (3) the total number of wells producing brine in the field, (4) the number of days per year the wells are producing, (5) the presence or absence of deep disposal wells, (6) the selling price of the recovered magnesium or its compounds, and (7) special chemical characteristics of the brine that would either inhibit or aid magnesium recovery.

TABLE III

(Prices Per Ton of Magnesium Compounds in 1942)

Compound	Price $ Ton
Magnesium oxide, powdered	58.75
Magnesium oxide, U.S.P. light	400.00
Magnesium oxide, heavy	500.00
Magnesium chloride, flake, 97% $MgCl_2$ $6H_2O$	32.00
Magnesium chloride, anhydrous	260.00
Magnesium sulphate, technical	36.00
Magnesium sulphate, U.S.P.	40.00
Magnesium carbonate, precipitated technical	125.00
Magnesium carbonate, precipitated, U.S.P.	180.00
Magnesium silicofluoride, technical	400.00

TABLE IV

(Number of Bbls. of Brine Required to Produce 2000 Lbs. of Metallic Magnesium per Day, from Brines Containing from 1000 to 3500 Milligrams of Magnesium per Liter.)

Milligrams Per Liter	Bbls.	Milligrams Per Liter	Bbls.
1000	5700	2300	2478
1100	5181	2400	2372
1200	4755	2500	2278
1300	4381	2600	2191
1400	4065	2700	2110
1500	3802	2800	2033
1600	3559	2900	1967
1700	3350	3000	1900
1800	3165	3100	1838
1900	3000	3200	1781
2000	2850	3300	1727
2100	2714	3400	1676
2200	2587	3500	1629

Quantity Important Factor

"At present, magnesium is being profitably extracted from ordinary sea water which has a magnesium content varying from 1040 to approximately 1400 milligrams per liter. Many of the Kansas oil field brines not only have a magnesium content equal to that of ocean water, but some have a much greater content, in some cases as much as double or triple the amount. So far as the magnesium content is concerned, many of the Kansas oil field brines qualify for magnesium recovery.

"Important as the magnesium content of a brine may be, it is, nevertheless, of little value for commercial magnesium recovery unless sufficient brine is produced. This relationship of high magnesium content to volume of brine produced is well illustrated by the brines coming from the Kansas City-Lansing formations. Brines produced from this pay zone have practically the highest magnesium content of any of the Kansas oil field brines. Analyses of the samples collected show a magnesium content varying from 972 to 3910 milligrams per liter, with an average of 2525 milligrams.

"So far as the magnesium content is concerned, the Kansas City-Lansing brines are very favorable for magnesium extraction. The amount of brine produced from wells drilled into this formation, however, is insignificant. Many of them produce practically no brine and most yield less than 20 barrels per day. In a few cases some of the wells furnish from 60 to 150 barrels of brine per day. Such wells, however, are exceptional. Table 4 shows the minimum number of barrels of brine required to produce 2000 pounds of metallic magnesium (or 6840 pounds of magnesium chloride) from brines containing from 1000 to 3500 milligrams of magnesium per liter.

"The number of barrels of brine required to furnish 2000 pounds of metallic magnesium varies inversely with the milligrams per liter magnesium content of the brine. In other words it takes a smaller number of barrels of brine to produce a given amount of metallic magnesium from a high magnesium brine than it does from one low in that constituent.

Deep Wells Essential

"Since a large amount of brine is necessary to insure the success of a recovery plant, and since chloride and other constituents are not removed, it follows that provision must be at hand for the disposal of the brine after the magnesium has been extracted. The most satisfactory means of disposing of the processed brine is by means of deep disposal wells. In many of the Kansas oil fields, deep disposal wells are now in existence; especially is this true in the oil fields of western Kansas. In such cases there would be practically no added cost in disposing of the waste brine.

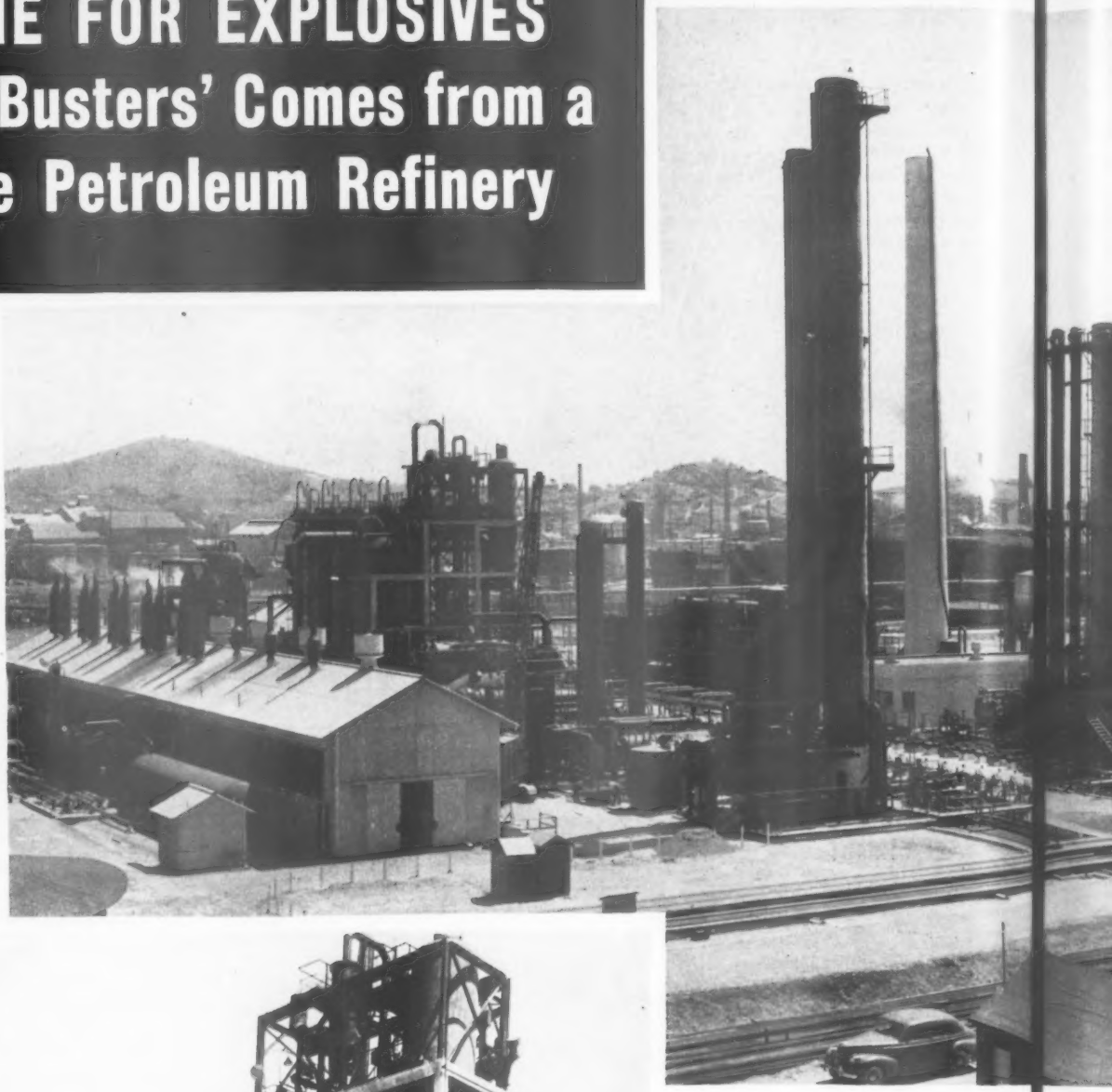
"The selling price of magnesium or its

TABLE V

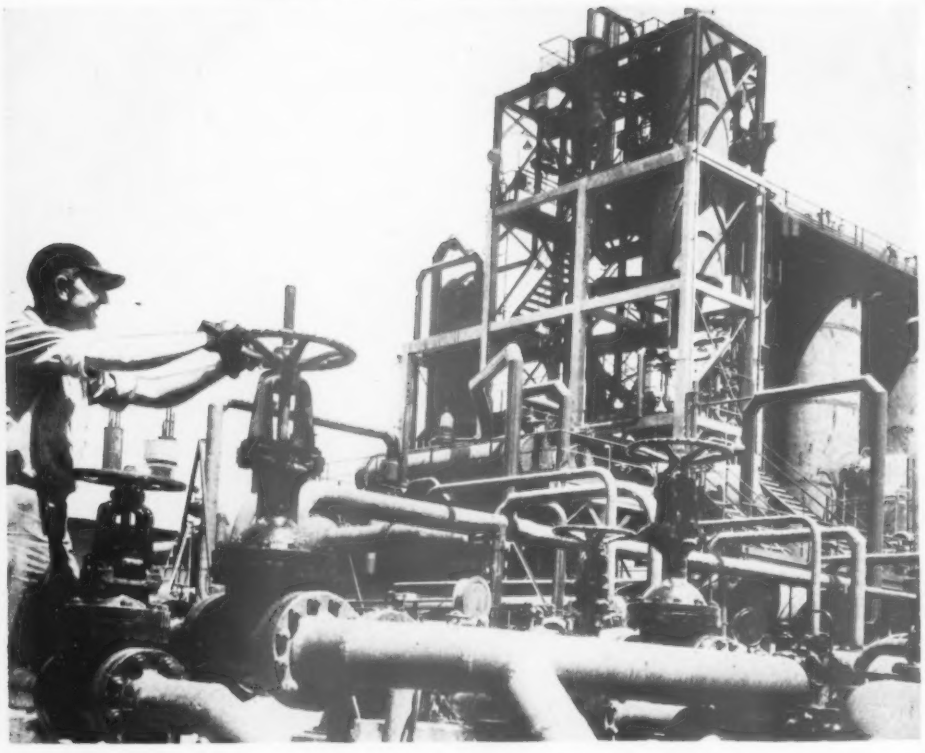
(Data on Kansas Oil Fields Worthy of Further Study for Possible Establishment of Magnesium Recovery Plants)

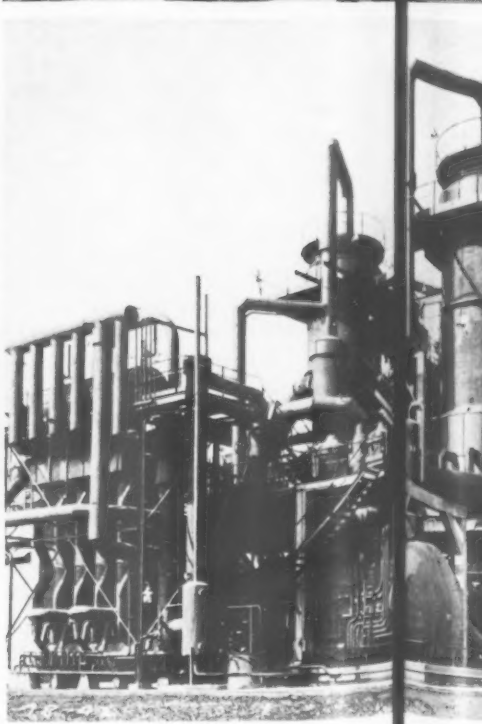
Field	County	Horizon	Prod. Wells	Theoretical Brine Prod. Per Yr., Bbls.	Disposal Wells	Avg. Mg. Content (Milligrams per Liter)	Avg. Metallic Mg. Content (Lbs. per Bbl.)	Theoretical Yield (Ton per Year) Metallic Magnesium	Theoretical Yield (Ton per Year) Anhydrous $MgCl_2$
Burrton	Reno	"Chat"	335	550,420,000	14	2263	0.773	212,737.3	858,655.2
Bornholdt	McPherson	"Chat"	150	23,118,750	2	1516	0.526	6,080.2	24,043.5
Zenith	Stafford	Simpson	301	21,973,000		1275	0.448	4,922.0	19,336.7
	Reno	Viola							
Welch	Rice	"Chat"	24	11,826,000	1	1395	0.492	2,909.2	11,471.2
		Topeka							
Oxford	Sumner	Hoover	19	4,401,900	1	2874	1.000	2,200.9	8,759.7
		Stalnaker							
		Layton							
Hall-Gurney	Russell	Kansas City	396	2,168,100		2912	1.010	1,094.8	4,368.7
		Lansing							

TOLUENE FOR EXPLOSIVES in 'Block Busters' Comes from a Wartime Petroleum Refinery



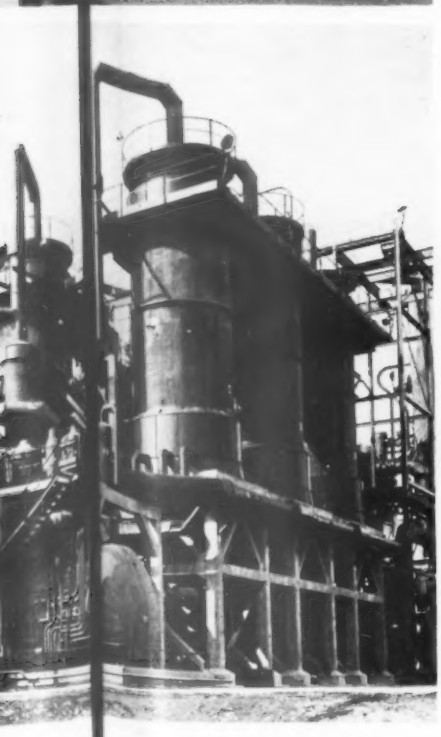
Right, general view of new toluene plant of Standard Oil Co. of California. At left in picture is compressor house, with catalytic section in rear. Center foreground is acid treating and final re-run towers. In center background is control house and behind it the stack from furnaces which heat stock to the catalytic section. On right are distillation towers and furnaces handling stock from catalytic section





Above is a closeup view of the re-run and catalytic sections of the Standard of California toluene plant, showing distillation section pumps in the foreground. Right is new Houdry catalytic cracking plant in the same refinery

Below is a portion of the new distillation unit for the manufacture of lubricating oil additive, at the Standard of California refinery. The young lady on the right is indicative of company's use of women in plant jobs



Above, new alkylation unit at Standard of California refinery, for manufacture of 100-octane aviation gasoline. At left in picture are acid reactors, with acid settler in foreground; center, fresh and spent acid tanks; right, distillation equipment

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compounds is another factor to be considered in establishing a magnesium recovery plant. The many uses to which magnesium and its compounds are adaptable, together with the growing demand for these substances, are certain to insure a fair selling price, not only during the war emergency but also in the future. It should be recognized that magnesium recovery from Kansas oil field brines is not on a competitive basis with larger establishments erected solely for the purpose of securing magnesium or its compounds. It is probable that Kansas oil field brines can never yield magnesium as more than a by-product of oil production. Such a by-product industry might pay the cost of brine disposal although showing little or no profit in itself. As an illustration, during the past 5 years, more than 6,863,100 barrels of brine having a magnesium content of 3199 milligrams per liter have passed through a single disposal system in the Burrton oil field in Reno county. One barrel of such brine contains 1.123 pounds of metallic magnesium. On that basis, 7,707,261.3 pounds, or 3853.6 tons, of metallic magnesium were returned to the underground strata during a five-year period. On the basis of the 1942 price, this amount of magnesium has a value of $1,734,120."

Fields Worthy of Study

High magnesium content, a large volume of brine and the existence of deep disposal wells make several oil fields in Kansas worthy of study for possible establishment of magnesium recovery plants, states the report. Fields which could theoretically yield 1000 tons of metallic magnesium per year include the Burrton field, Reno county; Bornhold field, McPherson county; Zenith field, Stafford and Reno counties; Welch field, Rice county; Hall-Gurney field, Russell county; and Oxford field, Sumner county. Data pertaining to these fields is given in Table 5.

The calculated tonnage of metallic magnesium given in the table is only of relative and comparative value and is based upon 2 assumptions. First, in computing the total amount of brine produced in any given field during the year it was assumed that the wells were pumped daily and at the same rate throughout the period. This would not actually be the case and the amount of brine shown in the table is accordingly too high, it is pointed out.

Second, in ascertaining the amount of metallic magnesium in a barrel of brine, as well as the potential yield, the specific gravity of the brine was taken as 1. On the basis of the chemical analyses, the specific gravity ranged from 1.014 to 1.159. If the latter variable specific gravities had been used instead of 1, the metallic magnesium content per barrel would be higher than those given in the table, and the theoretical yield of metallic magnesium would have been increased accordingly.

Ten Commandments for Technical Men

(Contributed by Paul P. Entrikin, chemist, Standard Oil Co. of Louisiana, Baton Rouge.)

I. Thou shalt not follow in the dust of progressing operations, but shalt run ahead with a lantern in thy hand to reveal the way.

II. Thou shalt seek and respect the opinions of operators, even unto the third helpers, for theirs is a wisdom unknown to technocrats.

III. Thou shalt determine what should be done and do it, without the necessity of others holding thy hand.

IV. Thou shalt not be too dignified to shoot the bull; neither shalt thou shoot it entirely, for so is its productivity destroyed.

V. Thou shalt not forsake the ways of thy technical training, so that to thee CH_2O°cease to be formaldehyde and become sea water.

VI. Thou shalt not take thy grievances and ideas first to the top, lest the bottom remove its support from under thee, saying, "We knew nothing of it."

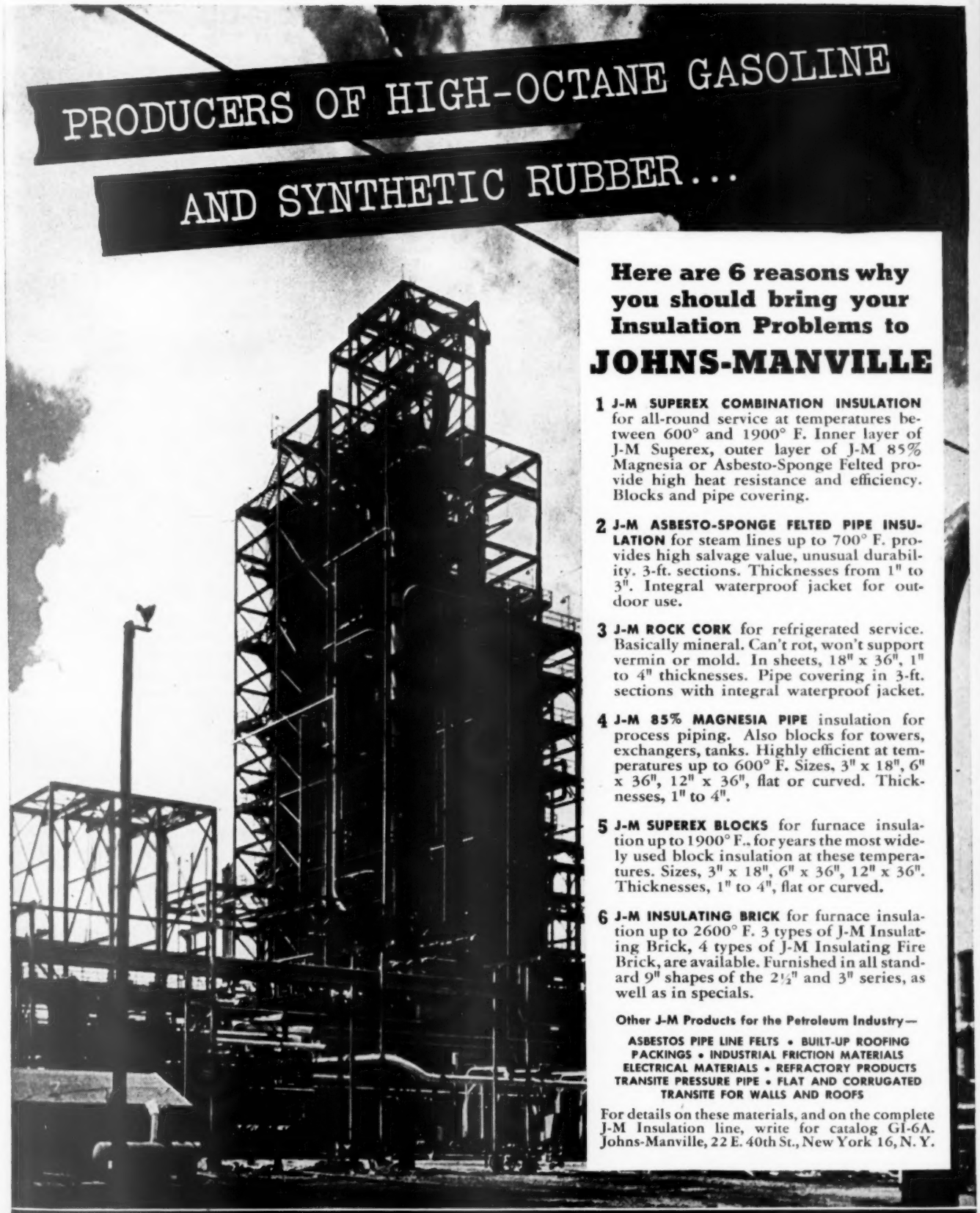
VII. Thou shalt remember that refining processes change not because of reasoning and meditation, however profound, but only by the turning of valves.

VIII. Thou shalt study thy conclusions from all sides through many viewpoints, for verily, undiscovered claws may rip thy rear.

IX. Thou shalt strive to make thy judgment as good as any man's by experimenting, observing, recording, calculating, studying, and thinking; and having done so,

X. Thou shalt use it.

(°and even a "technocrat" can make a slip.—The Author)



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Armour Institute is Clearing House For Heavy-Duty Oil Test Data

To simplify acceptance test procedure for heavy-duty crankcase lubricating oils by the Army, Armour Research Foundation's Engine Research Laboratory at Chicago has been designated as the sole recommending group to which results of tests are to be transmitted. The Foundation in turn, functioning as an entirely unbiased examiner, will transmit its findings to Army Ordnance, which will accept or reject the product.

The acceptance requirements set-up existing until recently under Army Specification 2-104A provided that Caterpillar Tractor Co. and General Motors Corp. acceptance tests be met, both necessitating actual full-scale engine tests. A committee of engineers from these two organizations, the Foundation, and representatives of Army Ordnance then considered the data from the engine tests, either accepting or rejecting the product.

Under the new arrangement provided in Specification 2-104B, Ordnance will be the final accepting body. The committee of engineers is eliminated, the Foundation acting as sole certifying body. The engine tests, still required, may be run either by the refiner in his own laboratory or by the Foundation as heretofore. However, all test data, together with samples of new and used oil, as well as rings, pistons, and bearings from the test engine must be submitted to the Foundation's engineers. The Foundation then will make the necessary final examinations, certifying all results to Ordnance. Ordnance has printed forms, instructions, and test specifications for refiners' use in submitting heavy-duty lubricants for acceptance by the armed forces.

Completes Second Year

Armour Foundation's Engine Research Laboratory recently completed its second year of existence. It entered the field of engine research at the instigation of the Caterpillar Tractor Co. and General Motors Corp. The Caterpillar company is one of the pioneers in testing of lubricants in Diesel engines, being "forced" into this field because of the previously unexplainable performance under service conditions of different lubricants when refined to the same specifications. It was found that of 2 oils, each refined to the same physical and chemical specifications, one might permit excessive wear as well as corrosion under service conditions, while the other, when used in the same engine under identical conditions, might largely eliminate these same difficulties.

The inadequacy of physical and chemical tests in the prediction of the service action of an oil may be exemplified in the introduction of highly solvent-refined lubricants for Diesel engines. According to physical and chemical tests, it was believed the solvent-refined oils would be far better lubricants than conventionally refined mineral oils then in use. Strangely enough, some solvent oils did perform better, but for many engine performance was less satisfactory than conventional mineral oils. Chemical and physical tests were thus nonconclusive. It was decided that the only way to correlate field with laboratory results was to test the oil in an engine—an empirical test that would give definite indications of actual performance.

Rigid Tests Provided

The engine tests which were independently developed by both Caterpillar and General Motors provide rigid specification of test conditions and analysis of the used oil. From these, estimates of suitability of an oil for heavy-duty service can be made. The chemical and physical tests include evaluation of an oil's oxidation resistance, detergency and dispersive ability, film strength, and its action with respect to commonly used bearing materials. Engine tests indicate an oil's ability to:

1. Maintain a very low wear rate for all rubbing surfaces.

2. Maintain an unbroken oil film between rubbing surfaces to prevent scratching, scuffing, or spalling.

3. Act as a coolant to keep rubbing surfaces cool and remove heat from such places as the under side of the pistons.

4. Act as a seal to minimize blow-by of air and products of combustion into the crankcase.

5. Maintain working parts in reasonably clean condition. This includes keeping the piston rings free in their grooves and the prevention of formation of excessive carbonaceous varnish or lacquer deposits which interfere with heat transfer and reduce operating clearances.

6. Maintain engine interior clean so that any sludge formed is removed in the drain oil or by the filter.

7. Prevent corrosion of copper-lead, cadmium-silver, and cadmium-nickel bearings by the action of oxidation products on the loaded portions.

8. Provide lubrication at lower operating temperatures and enable easy starting under adverse conditions.

Formerly, Caterpillar and General Motors both accepted and tested samples from various sources, developing a list of "approved oils" for the guidance of users of their engines. But it was felt that better results would accrue if a neutral, unbiased group made the tests and reported results to the refiner submitting the sample and to the 2 Diesel engine manufacturers. Accordingly, two years ago the Armour Foundation set up its test laboratory.

Three Types of Research Tests

The Foundation's engine laboratory now contains 2 types of spark-ignition and 5 types of compression-ignition engines: a total of 14 engines in all. Some are operating under conditions simulating the desert climate which United Nations' troops faced in Africa; others simulate conditions found in other parts of the world in which our mechanized armies may have to operate. Still others perform specialized tests which have to do with confidential research in connection with Lend-Lease operations.

The war-caused scarcity of many components of heretofore widely-used additives has caused a swing in the trend of additive development, it is stated at the Armour laboratories. The emphasis now is on additives derived from non-critical materials. In addition, the development of new refining processes has enhanced the possibilities of many oils for heavy duty service—providing the proper type of additive can be developed. The peacetime additives frequently require priority material both in the additive and the process used to make the additive. Usually the additive is a metallic soap, employing as the metal tin, zinc, aluminum, magnesium, barium, calcium, cobalt, and lead, to name a representative few. Now research is trying to eliminate the metal or metallic salt, but still retain the desirable qualities of the metallic soap while dispensing with its undesirable properties. Fish, animal and vegetable oils, as well as fats and waxes from agricultural sources are being investigated for suitability as additives; agricultural waste products and industrial by-products are being examined for use as compounding agents.

The various types of filters in conventional use are being examined in the Armour laboratory, especially with reference to the new types of oils which are being developed. Filter manufacturers are co-operating with the Foundation in this work.

Spark plugs are investigated too. In the absence of but few accepted evaluation tests for spark plugs, the Foundation has performed extensive laboratory examinations followed by actual use under severe performance conditions.

Wear in internal combustion engines from the lubricant, the lubricant additives, and the fuel additives (upper-cylinder lubricants and anti-knock agents) are being studied in spark- and compression-ignition engines. Special reference is being made to corrosion caused by intermittent operation, while an attempt is being made to develop a test procedure for evaluating upper-cylinder lubricants so that closer correlation with field results can be accomplished.

Use of Petroleum Products in Aircraft*

Data on pressures and temperatures of the atmosphere in which aircraft must operate are presented to aid in understanding why petroleum products entirely suitable for use in motor vehicles on the ground are frequently unsatisfactory in aircraft. Pressure variations influence the vapor locking tendencies of the fuel, particularly under present high altitude flight conditions. Air solubility in gasoline tends to offset the effect of decreased front end volatility under conditions approaching vapor lock, it is stated. With engine oils, greatest need is said to be for improved stability with consequent reduction in engine deposits.

Requirements for hydraulic, instrument, and machine gun oils are described and trends in aircraft greases outlined, with emphasis on simplification to reduce the number of products required. An explanation is given of the varying requirements of corrosion preventives, both for exterior surfaces of parts and for interiors of engines.

By Frank D. Klein**

Aircraft operate under a wide range of atmospheric pressures varying from sea level to less than one-fourth of sea level. Fig. 1 shows the variation in pressure with altitude. It is seen that atmospheric pressure at 17,600 ft. altitude is half of that at sea level; at 33,200 feet it is only one-fourth; and at 48,000 ft. altitude it is only one-eighth of that at sea level. These pressure variations influence chiefly the vapor locking tendencies of the fuel system.

Other factors bear consideration, however. For example, under conditions of thorough contact and agitation, air is soluble in aircraft hydraulic oil to an appreciable extent at atmospheric pressure. When the pressure on hydrau'ic oil so saturated with air at normal sea level pressure has been reduced to 75 mm., equivalent to an altitude of 10,750 ft., the volume of air liberated is substantial, in comparison to the volume of the oil itself. Although the major part of the hydraulic system of aircraft remains under high pressure, designers must consider the air which is liberated at low pressure in the supply reservoir. Also of current importance is the release at low atmospheric pressures of air dissolved in the engine lubricant, which in some cases may contribute to the problem of oil tank foaming.

Temperature variations have a marked effect on the properties of lubricants, and atmospheric temperature limits encountered in aircraft are therefore of interest. As is well known, ground temperatures frequently exceed 110°F., not only in deserts, but in some of the hotter airports in this country. Aircraft standing in the sun at these high temperatures often become much hotter. At the low temperature end of the scale many of our northern areas experience ground temperatures as low as —20 to —40°F. Until recently it was generally believed that the stratosphere, in which temperature ceases to fall with increasing altitude, began at about 36,000 ft. altitude and had a constant temperature of —67°F. It is now known that the tropopause, which marks the lower level of the stratosphere, varies in height above the earth's surface, being higher near the equator than near the poles. Even in a given locality it varies somewhat in height from day to day. The temperature of the stratosphere varies inversely as the height of its lower surface above the earth, which accounts for stratosphere temperatures of approximately —50°F. over the poles, as compared with about —120°F. over the equator.

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Temperature Data Tabulated

Air Research Mfg. Co. has tabulated some interesting data on temperatures at various altitudes and localities, based

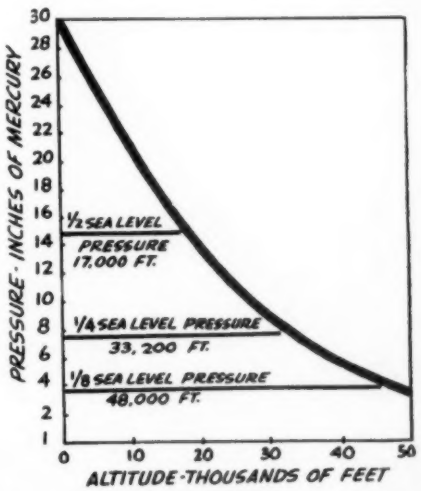


Fig. 1—Variation in pressure with altitude for standard atmosphere

* Presented before the National Fuels and Lubricants Meeting of the Society of Automotive Engineers, Tulsa, Oct. 22, 1942, and now released for publication.

** Aviation technologist, Standard Oil Co. of New Jersey.

upon U. S. Weather Bureau reports for 1940. A portion of its data has been reproduced here. First consider a cold climate such as recorded at a northern station, shown in Fig. 2. The lowest temperature encountered on the ground was —39°F. and the highest temperature +88°F. The lowest temperature

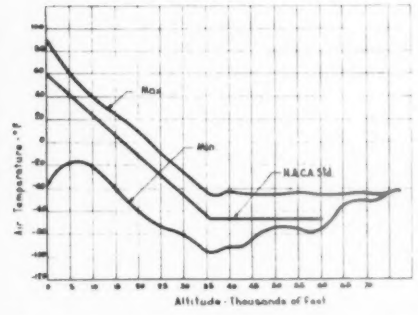


Fig. 2—Variation in temperature with altitude at a northern U. S. Weather Bureau station

at altitude was —97°F., which occurred at 36,000 ft. For comparison, consider how a warm climate such as at Miami, Fla., fares. From Fig. 3 it is seen that the highest temperature encountered was 92°F., only a few degrees above that shown in Fig. 2. The lowest temperature on the ground was +30°F., which does not compare too unfavorably with their advertising. However, it is surprising to note that a temperature of —120°F. was encountered at 53,000 ft. altitude. Fig. 4 shows the conditions at Oklahoma City.

On Fig. 5 the altitude and temperature of the tropopause are plotted against latitude, based upon data from various localities. From these it is clear that from the equator to the North Pole the tropopause lowers and its temperature increases.

Having described the atmosphere that aircraft must fly in, the requirements and limitations of petroleum products for use in aircraft are better understood. Some of these products, such as control bearing lubricants, are most critical to the low temperatures discussed, since they never reach temperatures much above atmospheric. Some, such as generator bearing lubricants, are most critical to high temperature since they are heated both by their own action and by the engine temperature, and do not have to operate long at extremely low temperatures. Others, in particular the engine lubricant, are critical to both high and low temperature since failure to operate satisfactorily at low temperature results in inability to fly the airplane, and failure at high temperature causes engine difficulties or increased maintenance.

B-24 Consolidated heavy bombers

Engine Lubricating Oils

Little can be reported on recent developments of engine oils. The greatest need is improved stability with consequent reduction in engine deposits. Detergents similar to those found so necessary for high speed Diesel engines have proven effective in improving aircraft engine cleanliness and reducing piston ring sticking. Cylinder wear is naturally of prime concern in any lubricant investigation, and it seems well to observe, in view of some opinions expressed in this respect, that present evidence does

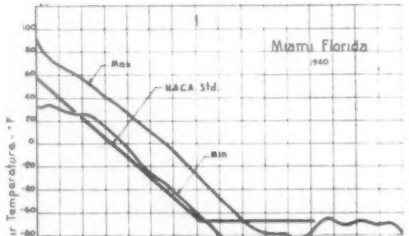


Fig. 3—Variation in temperature with altitude at Miami, Fla.

not indicate that cylinder wear is necessarily increased with the use of detergent type lubricants. As to the use of anti-oxidants, separately or in conjunction with detergents, it would appear that addition agents of this type utimately may contribute importantly to the stability requirements of lubricants for high output engines.

The oil dilution system is in general use on aircraft which must be started quickly at very low temperatures. A small portion of the engine oil is diluted with gasoline upon shutting down the engine, so that easy cranking will be obtained for later starting. In addition to reducing cranking torque, this dilution lowers the pour point of different types of oil to a varying degree. For greatest effectiveness with the oil dilution system, the engine oil should be reduced rapidly in pour point when diluted with small percentages of aviation gasoline.

Aviation Gasoline

Maximum efforts are being exerted toward the greatly increased production

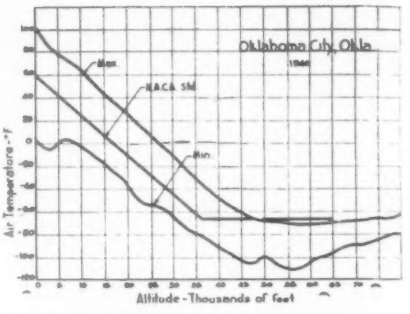


Fig. 4—Variation in temperature with altitude at Oklahoma City

of 100 octane fuel of required full power performance characteristics, and the further improvement of anti-knock value above 100 octane. Many new alkylation and catalytic cracking plants are in operation and many more are under construction to augment the supply of high octane fuels. Moderate quantities of special addition agents are being used as a means of increasing full power performance. This has necessitated the development of fuel system materials resistant to many types of fuels.

With aircraft ceiling continually being raised, vapor lock problems require serious consideration. Under present-day high altitude flight conditions, air solubility in gasoline is of much importance and actually tends to offset the effect of decreased front end volatility under conditions approaching vapor lock. Many newly developed protective measures, such as pre-flight cooling of the fuel on the ground and centrifugal and float controlled vapor separators appear to be feasible.

Engines in some types of light planes, it should be observed, have had to suffer unavoidably by change in fuel quality

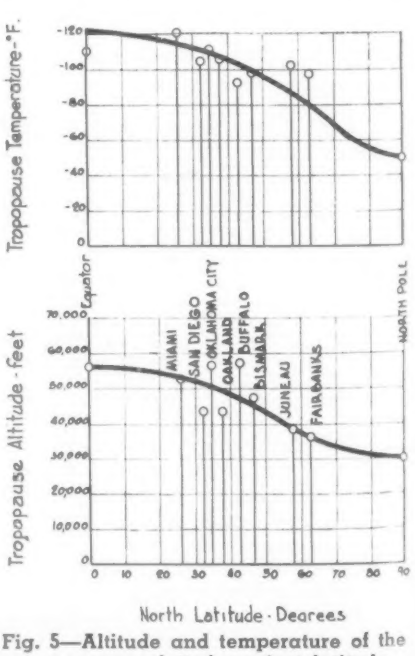


Fig. 5—Altitude and temperature of the tropopause plotted against latitude

necessitated by increased requirements for high octane fuels. Until recently unleaded 73 octane number fuel and 80 octane number fuel containing not over ½ cc. of tetraethyl lead per gallon were in general use. Under current government restrictions on maximum base stock octane number, these fuels are no longer available. Present 73 octane number fuels contain about ½ cc. of lead per gallon, and 80 octane number fuel contains about 1¾ cc. of lead per gallon. Some of the light engines designed to operate on unleaded 73 octane number fuel are giving satisfactory service with either the present 73 or the 80 octane number grade, because of the use of materials resistant to the corrosive action of the products of combustion of leaded gasoline.

Exhaust valves, valve seats and exhaust disposal systems are the most critical items in this regard. Engines not so protected are experiencing increased maintenance difficulties due to the high tetraethyl lead content. The solution to this problem appears to depend upon the ability of the engine manufacturers, in the face of critical material shortages, to supply necessary parts of corrosion-resistant material, since there seems to be no hope of a change in the government restriction on aviation fuels for some time. All of the larger engines operate satisfactorily with fuel containing up to at least 4 cc. of tetraethyl lead per gallon.

Hydraulic Oil

Two grades of hydraulic oil are now standard for aircraft hydraulic systems. The medium grade is in general use, and is satisfactory down to temperatures as low as 0°F. to —20°F., depending upon the particular equipment. For lower temperatures the light grade has been necessary and with newly designed pumps now available, it can be used for most of the hydraulic equipment under all climatic conditions.

A hydraulic oil to give excellent performance under all conditions should have a viscosity about equal to the present light grade at —40°F. and about equal to the present medium grade at +130°F., with other properties, including rubber swelling, pumpability and leakage, about equal to the present medium grade. A specification for such a product has already been issued. Special additives to improve oiliness are available, but have not proven necessary and are not permitted by latest specifications.

There has been some indication of a need for rust preventive type of hydraulic oil for use in unusually corrosive atmospheres such as near sea water. While such products are available, it is not yet known whether the need will be serious enough to justify service use.

Specialty Oils and Fluids

Marked improvements have been made recently in certain specialty oils for aircraft use. It has been found desirable to improve low temperature properties and stability of instrument oil, and to add agents to improve oiliness and impart rust preventive qualities. Similar improvements have been made for machine gun oil.

Martin B-26

For a limited number of applications, such as lubrication of remotely driven propeller reduction gears, an extreme pressure oil is used. It is possible that improved low temperature characteristics will be needed because of the increase in cold weather flying.

Greases

Aircraft greases probably are receiving more attention at this time than any other type of petroleum lubricant for aircraft. In any discussion of greases it must be borne in mind that, in general, oil provides better lubrication than does grease, provided that it can, without leakage, be maintained in contact with the surface to be lubricated.

However, besides having greater load-carrying ability than straight mineral oils, greases possess the marked advantage of changing less in consistency with temperature variations than oils, thus making it easier to keep them in their place through wide temperature fluctuations.

The activity now involving aircraft greases probably is due chiefly to the following:

(1) Need for improved low temperature characteristics because of increased flying in cold weather and at high altitudes.

(2) Development of improved laboratory tests to evaluate such vital characteristics as oxidation stability, bleeding and low temperature torque.

(3) Development of sealed "lubricated-for-life" bearings.

(4) Development of improved greases suitable for greater temperature range.

(5) Desirability of simplifying the lubrication problem by reducing the number of greases required, both by improving the suitable performance range of greases and by consolidation of lubricant recommendations so as to increase the number of units for which available greases are suitable.

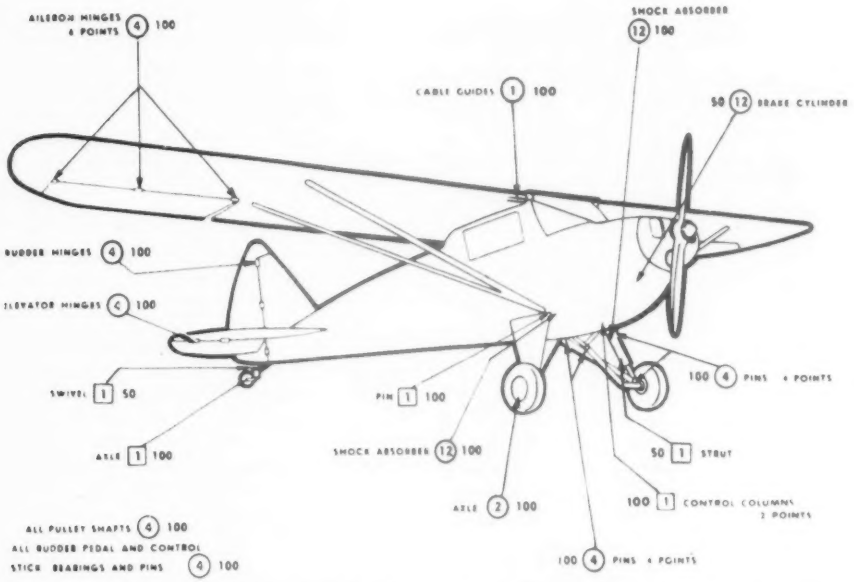
An ideal grease would be one which could be used for all units requiring grease lubrication for the entire temperature range encountered. Unfortunately no single grease is known at present which will meet these requirements. One type of grease has become standardized which satisfactorily lubricates most of the aircraft and accessory units subject mostly to low temperatures. This covers almost all intermittently-operated units, such as control bearings, retracting mechanisms, etc., as well as some continuously operated units such as magneto gears.

The low temperature grease in general use at the present time is a water-resistant product formulated with oil of low viscosity and pour point. Specifications limit such characteristics as bleeding, oxidation and low temperature torque. It should be emphasized that low temperature torque cannot be judged by the consistency or appearance of the grease, since it is based upon the properties of the base oil, together with the characteristics of the soap and the method of formulation. For example, an oil in the fluid state might readily have higher torque than a grease of stiff consistency.

Units which operate a large part of the time appreciably above normal atmospheric temperature require the use of high temperature grease. These generally include such items as continuously-operated motor and generator bearings, and also wheel bearings, since they often get very hot due to the action of the brakes.

Various types of high temperature grease are now in general use, but standardization of a specification is expected in the near future, which should provide for almost all grease lubrication which cannot be accomplished with the present low temperature grease.

While many units such as retracting gear boxes and other screw mechanisms which were formerly believed to require extreme pressure lubricant are now operating satisfactorily with low temperature grease, there has been a limited but definite need for an E.P. grease of good low temperature characteristics. A product that meets these requirements is a modification of the present low temperature grease containing an E.P. additive. Unfortunate though it seems for simplification, there also appears to be some need for a semi-fluid grease of good low temperature characteristics for use in some gear mechanisms in which channelling of the standard grease at low temperature seriously interferes with adequate lubrication. Such a product


AILERON HINGES 4 POINTS (4) 100
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CABLE GUIDES (1) 100
50 (12) BRAKE CYLINDER
RUDDER HINGES (4) 100
ELEVATOR HINGES (4) 100
SWIVEL (1) 50
PIN (1) 100
100 (4) PINS 4 POINTS
AXLE (1) 100
SHOCK ABSORBER (12) 100
50 (1) STRUT
AXLE (2) 100
100 (1) CONTROL COLUMNS 2 POINTS
ALL PULLEY SHAFTS (4) 100
ALL RUDDER PEDAL AND CONTROL STICK BEARINGS AND PINS (4) 100
100 (4) PINS 4 POINTS

Fig. 6—Lubrication diagram for light airplanes. Squares denote grease gun application; circles hand application; number inside the square or circle is the lubricant symbol; figure outside indicates number of flight hours between servicing operations. Symbol (1) is high pressure grease, (2) high temperature grease, (4) light lubricating oil, (12) hydraulic oil

is available, but manufacturers should determine by test that the standard grease is not satisfactory before resorting to special greases. Similarly, now that greases are becoming more standardized, units should be designed to operate with the standard grades whenever possible, avoiding designs requiring E.P. or other special lubricants, and providing good sealing. In the past some mechanisms which galled unless operated with E.P. lubricant were modified to operate satisfactorily with conventional grease by changing the gear material or, in some cases, by merely changing heat treatment to increase gear hardness.

Many points on aircraft such as hinges, joints, etc. require "oil can" rather than grease lubrication. For best operation a low temperature oil combining lubricating and rust preventive properties may be used.

To assist personnel who service many models of aircraft in correctly lubricating each model, lubrication diagrams similar to those used at automotive service stations are very helpful. Fig. 6, representing several models of light aircraft, shows an example of how this is done. Each lubrication point is identified by a square, indicating grease gun application, or a circle, indicating hand application. The numbers inside the squares and circles are symbols identifying the proper lubricant, and the figures beside these squares and circles indicate the number of flight hours between servicing operations. Larger airplanes with several engines, wing flaps, engine cowl flaps, and many retracting mechanisms are naturally more complicated, but similar diagrams can be prepared.

Lubrication of Accessories

In spite of the desire to simplify greasing, many accessories now require special lubricants. Aircraft manufacturers and operators would be benefited greatly if as many accessories as possible could be lubricated with the greases being standardized for the airplane itself. In many cases this is feasible, but in some cases it is not possible to avoid specialized lubricants. Inertia starters and Prestone pumps of liquid-cooled engines now use special lubricants, but standardized greases might later prove satisfactory. Space does not permit a discussion of the lubrication of the innumerable other accessories used in aircraft.

Thread Lubricants

Various types of anti-seize products are available for the threaded fittings of different classes of equipment, such as spark plugs, fuel and oil lines, hydraulic lines, oxygen lines, and other fittings.

Corrosion Preventives

Prevention of corrosion in conjunction with lubrication has already been mentioned in connection with certain specific lubricants. Corrosion prevention during storage and shipment, as applied to aircraft, falls into 2 distinct classes, the protection of exterior surfaces of parts, and the interior protection of aircraft engines.

As regards exterior parts protection, no single corrosion preventive will meet all requirements. Primary consideration must be given to whether the parts are to be stored indoors, outside in open sheds, or outdoors exposed to the elements. These factors largely govern the consistency required of the corrosion preventive. For example, outdoor exposure would necessitate a relatively hard protective film, which would normally be applied in the hot state, whereas indoor exposure would usually be satisfactory with a thin film applied by dipping or spraying at room temperature, and readily wiped off when desired. Corrosion preventives generally consist of a rust-inhibiting base incorporated into a liquid or solid vehicle, depending upon the desired method of application and type of protective film needed for the particular storage conditions involved.

Concerning the interior protection of aircraft engines, there are two special requirements not applicable to other corrosion preventives. First is the ability to neutralize hydrobromic acid, traces of which are formed in engine interiors due to condensation of the products of combustion of leaded gasoline. Second is the requirement that engines be operable on the corrosion preventive compound without detrimental effects since treatment procedure involves operation of engines on the compound in place of engine oil for the last 15 minutes of running before shut-down for storage or shipment. For this reason the compound must have properties similar to those of engine oil itself, together with rust-preventive characteristics.

Humidifier Life

Among the many specified requirements of all corrosion preventives, probably the most significant single one is the humidifier life test. Equipment and conditions have not yet been universally standardized, but usually involve a chamber in which specimens are mounted and subjected to controlled temperature and humidity conditions. The specimens are examined periodically. The number of hours before initial appearance of rust spots is considered the humidifier life of the particular corrosion preventive. In such tests the life of conventional mineral oils of moderate viscosity is usually about 1 to 2 hours. A life of well over 100 hours is desirable for any corrosion preventive. Estimated performance based on results of humidifier tests must be confirmed by service tests.

Acknowledgments

The author gratefully acknowledges the courtesy of Air Research Mfg. Co., Los Angeles, in authorizing publication of weather data from its Report PC-20-R entitled "The Variation of Air Temperature with Altitude."

Canada Backs Development Of Alberta Oil Sands

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553

The Canadian government has appropriated $700,000 to speed up exploratory work on the recovery of oil from the tar sands in northern Alberta Province, where it is said a huge petroleum reserve exists amounting to 100,000,000,000 bbls. or more.

The government has taken title to the operations of Abasand Oils Ltd. of McMurray and is to spend $500,000 on improvements to its plant. It also has a $200,000 contract with an engineering concern for exploratory work. The rapid expansion of military and civilian demand for petroleum products in the northwest portion of the country, and Alaska, and a possible shortage of crude petroleum in the U. S., have stimulated plans for commercial exploitation of the oil sands.*

C. D. Howe, Minister of Munitions and Supply for Canada, in a report to the House of Commons April 14, 1943, said that the government had also reinforced the management of the Abasand company and intended to do everything possible to put the plant into operating condition for experimental purposes chiefly. The Abasand plant, with a rated capacity of recovery of 350 bbls. of oil a day from the sands, was damaged by fire in 1941, and has been rebuilding. John Irwin, president of Canadian Oil Cos., Ltd., which operates a refinery at Petrolia, is now president of Abasand. E. A. Smith, Canadian Oil Cos.' refinery superintendent, is vice president and managing director. Max W. Ball, geologist and former member of the U. S. Bureau of Mines staff, who was formerly president, remains as consultant for Abasand.

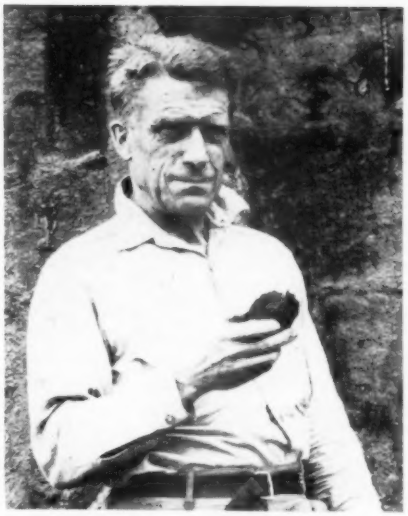
Confer With U. S. Officials

Minister Howe also brought out in his report to the House of Commons that the Canadian government had a $200,000 contract with the Consolidated Mining and Smelting Co. of Canada, to study, with the cooperation of Abasand, contemplated recovery processes, procure samples to determine what products can be secured from the sand-oil, and estimate costs of production.

"Negotiations have been carried on by the oil controller with the Office of Petroleum Administrator for War at Washington," said Minister Howe, "with a view to having organizations in the U. S. make thermal and catalytic cracking and hydrogenation tests of the samples, particularly in respect to the possibility of obtaining aviation gasoline, motor gasoline, Diesel oil and fuel oil. As a result, arrangements were made for laboratory tests by Universal Oil Products Co. of Chicago on thermal and catalytic cracking and by Standard Oil Development Co. of Baton Rouge on hydrogenation.

"Inasmuch as hydrogenation on a large scale would require an expenditure of possibly $12,000,000 or more, the research by Universal on thermal and catalytic cracking was considered advisable since if it were successful the cost, though substantial, would be less than by hydrogenation. The great advances made in all refining operations, particularly since the war, unquestionably would help in the solution of refining and sulfur reduction problems."

Removal or treatment of the sulfur in the oil recovered from the Alberta sands is recognized as one of the chief problems to be solved before commercial recovery is practicable. "The material carries a very high sulfur content, around 7 or 8%," said Mr. Howe, "and no method of removing the sulfur from the oil has been discovered except hydrogenation, which requires a very expensive plant."



S. C. Ells, of the Canadian Department of Mines and Resources, Ottawa, known as the "father of the Athabaska oil sands", because of his early explorations there, inspects a sample of the oil-bearing sand

Studies Cover 30 Years

The Howe report states that for 30 years the tar sands of Alberta at and around McMurray have been under investigation by engineers of the Department of Mines and Resources of Canada. While it is known that there are large deposits of oil in these sands, many problems still remain to be solved before they can be recovered and processed into gasoline and other marketable products. The problems involved in any commercial recovery project include the following, Minister Howe reported:

"Economic methods of mining the sands.

"Separation of the oil or bitumen from the sands.

"Treatment of the bitumen after it is separated to produce marketable products.

"Removal or at least substantial reduction of the high sulfur content of the crude products obtainable from the extracted bitumen. With the high sulfur content of the bitumen, there is consequently high sulfur in the lighter fractions, i.e. gasoline, Diesel oil, etc. This sulfur must be removed to obtain marketable products.

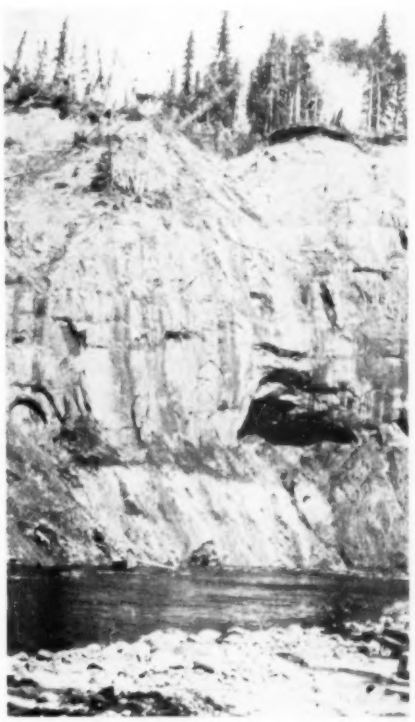
"A thick uniform rich deposit of sands with light overburden had to be located.

Waste a Big Problem

"A solution had to be found for the disposal of the overburden and waste so as not to pollute any navigable stream or body of water. When it requires a ton of sand to produce a little less than a barrel of bitumen, in a deposit of the type of Horse river, the magnitude of the tonnage of tailings to be disposed of can be understood more readily.

"Transportation had to be found for the movement of the products to the market at reasonable cost."

In addition to the developments reported by Minister Howe it is said that engineers of the Department of Mines and Resources are test drilling on locations about 24 miles below McMurray, on the Athabaska river, to determine the thickness and degree of saturation of oil sands there. Another company, Oil Sands Ltd., is rejuvenating a small recovery plant erected by International Bitumen Ltd., on the Athabaska about 50 miles below McMurray with the intention of producing asphalt from the sand-oil by the close of the year.



Exposure of bituminous sand on the north side of Steepbank River, illustrating the massive structure and cleavage typical of the richer grades of bituminous sands. (Photo by S. C. Ells.)

*"Alberta's Oil-Impregnated Sands Provide Huge Petroleum Reserve", Technical Section, NATIONAL PETROLEUM NEWS, Sept. 1, 1943, p. R-387.

Contamination by Successive Flow in Pipe Lines*

By Frank C. Fowler** and Geo. Granger Brown***

ABSTRACT

In the transportation of different fluids in pipe lines, it is customary to pump one product immediately after the other. This leads to contamination of a portion of the material delivered from the far end of the pipe line. The paper reports experimental work in the laboratory under conditions where the contaminated portion may be determined with much greater precision than is possible in commercial lines. Fluids used consist of water and salt solution of almost identical physical properties covering viscosities from about 0.8 to 1.5 centipoises, Reynolds numbers from less than 200 to 19,800, and length divided by diameter ratios from less than 200 to over 10,000.

In the laminar flow region the contaminated portion was found to be independent of Reynolds number as is indicated by a theoretical analysis.

In turbulent flow the contaminated portion may be computed by the following equation:

$$\log_{10}(\text{contaminated portion}) = \log_{10}(\text{pipe volume}) - 0.4\log_{10}\left(\frac{L}{D}\right) + c$$

in which c is a function of the Reynolds number and the range in instantaneous composition defining the contaminated portion.

The above equation is applied to commercial pipe line data covering the transportation of oil products, using the average Reynolds number of the two products in the above equation. The commercial data cover viscosities varying from 0.51 to 7.4 centistokes, corresponding to Reynolds numbers from 27,000 to 610,000 (average Reynolds numbers from about 55,000 to 537,000) and length over diameter ratios from 437,000 to 1,765,000.

INTRODUCTION

In recent years a new problem in fluid flow has developed in the operation of "product pipe lines." These pipe lines transport a number of different petroleum products through the same pipe line for distances of several hundred miles. These different products flow through the pipe line as successive slugs or "tenders" without any separating medium. Under these conditions mixing of the two streams always occurs to form a slug of contaminated material between the tenders of the different uncontaminated products. The extent and degree of mixing in this contaminated portion depends upon the diameter and length of the pipe line, and the velocity and viscosity of the fluids flowing therein. The quantitative relationships between these variables is an interesting problem, of considerable value in the design and operation of product pipe lines.

The first published investigation on contamination in pipe lines was reported in 1911 by Schoder,[7] who studied the mixing taking place between heavy and light oils and between a dye solution and water when flowing successively through a 6-in. line. Schoder concluded from his limited experiments that the volume of the contaminated portion appeared to be a constant percentage of the total volume of the pipe.

In 1927 it was reported [1] that a slug of natural gasoline had been pumped through a 4-in. crude oil pipe line 90 miles in length with a small amount of mixing between the two materials.

The construction of a products pipe line by the Phillips Petroleum Co. in 1931 resulted in several articles [2,3,8] discussing this pipe line, with the prediction based on experiments in a 3-in. line of 24 miles [8] that the amount of mixing expected would be a few hundred barrels in an 8-in. line of about 700 miles.

In 1933 Kashcheev [5] reported data on the mixing of gasoline and kerosene pumped through a pipe line extending from Baku to Batum. The flow was intermittent and the use of water-sealed reservoirs at all pumping stations complicated the problem. However, Kashcheev presented two conclusions. First, that the amount of the contaminated portion will not increase proportionally to the length of the pipe. Second, that the greater the diameter and the slower the flow, the greater the amount of contaminated material obtained.

THEORETICAL DISCUSSION

Viscous Flow

Viscous flow in a pipe is characterized by a parabolic velocity distribution curve and a direction of motion at any point in the pipe that is always parallel to the axis of the pipe. If two adjacent fluids are flowing one behind the other through a pipe under ideal viscous flow, the interface will remain distinct, providing diffusion takes place to a negligible extent. Fig. 1 presents diagrammatically the interface between fluid *A* followed by fluid *B* in laminar or viscous flow as seen in a cross-section through the pipe.

Assuming diffusion is negligible, it is possible to derive † the following equation for the theoretical amount of contamination obtained when the fluids are in viscous flow. Contaminated portion as fraction of pipe volume =

$$\frac{1}{2}\left[\frac{1}{(x_2)^{1/2}} - \frac{1}{(x_1)^{1/2}}\right] \quad \ldots\ldots\ldots (12)$$

The contaminated portion given in this equation is the volume of fluid collected during the time that the instantaneous composition changes from x_1 to x_2. Instantaneous composition, x, is the instantaneous volume of fluid *A* divided by the instantaneous total fluid volume. The average composition $(\overline{x})$ of the contaminated portion collected over the instantaneous composition range x_1 to x_2 can be expressed as

$$\overline{x} = (x_1 x_2)^{1/2} \quad \ldots\ldots\ldots (15)$$

Table I gives the volume of the contaminated portion collected between the indicated instantaneous compositions as a percentage of the total pipe volume as computed from Equation (12), and the average composition of the collected portion as computed from Equation (15).

It is interesting to see that theoretically the amount of contamination is proportional to the length of pipe and is independent of Reynolds number, providing the flow is in the viscous region.

Turbulent Flow

In the turbulent flow the velocity of any particular particle is chaotic. It is not constant in either direction or magnitude. Thus the interface between two fluids pumped in succession in turbulent

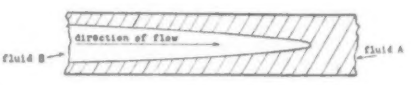


Fig. 1—Diagrammatic representation of the interface between two fluids flowing successively through a pipe in viscous flow

*Presented before American Institute of Chemical Engineers, New York, May 10-11, 1943; Published in Aug. 25, 1943, Transactions of the Institute.

**Phillips Petroleum Co., Bartlesville, Okla.

***Department of Chemical and Metallurgical Engineering, University of Michigan.

†The derivation of equations for the theoretical amount of contamination in viscous flow is given in an appendix, publication of which is omitted. The numbers shown with the equations refer to their order in the derivation.

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flow does not remain distinct, but is immediately destroyed. If two fluids move successively a distance through a pipe in turbulent flow, a mixture of the two fluids is found separating the pure fluids.

The mixing of pure fluid *B* with a quantity of a mixture of *A* and *B* will result in less contamination of the fluid *B* than if it had been mixed with the same quantity of pure fluid *A*. Therefore the presence of the mixture between the two fluids serves as a buffer decreasing the amount of contaminated portion delivered by the pipe. If this reasoning is sound, an increase in turbulence would decrease the contaminated portion. The quantitative effect of turbulence on the contaminated portion is probably indicated by its effect on the velocity distribution curve [6] and is probably greatest at the lower Reynolds numbers.

EXPERIMENTAL WORK

Most of the experimental data were obtained using dilute salt solutions (0.139 *N* NaCl) and water as the two adjacent fluids flowing through a glass tube. Dilute salt solutions have viscosities and densities nearly equal to those of pure water. Mixtures of the salt solution and water are easily analyzed. The approach of the contaminated portion to the end of the glass tube could be observed by coloring one of the streams by the indicator, potassium chromate, used in the titrations.

Glass tubes of 0.124 ins. and 0.313 ins., and lengths varying from 5 feet to 105 ft. were employed. A three-way stopcock provided a ready method of introducing the following liquid directly behind the leading liquid. Both liquids were supplied from constant-head tanks. For high velocities, air pressure was supplied to the top of the constant-head tank containing the following liquid.

The fluid stream, upon leaving the end of the tube, was caught in a series of beakers in a cart which was moved past the end of the tube at constant velocity by winding a wire, attached to the cart, upon a drum revolved by an electric motor.

The cart containing the beakers was placed in position. The glass tube was then filled with the leading liquid, its temperature recorded, and the desired pressure applied to the constant-head tank, containing the following liquid. Then the run was started by turning the stopcock to the following liquid. Since the water was colored, the contaminated portion could be observed as it moved down the glass tube. Just before it reached the end of the tube, the cart was started, causing the liquid leaving the tube to fall into the beakers. The time during which the beakers collected liquid was reported by a stopwatch. The temperature of the following liquid was taken after the samples were collected.

In order to determine what, if any effect variations in the operation of the stopcock might have on the results, in some runs after the tube was filled with leading liquid the end of the tube was closed by a cork and the stopcock was turned to the following liquid. The time interval between turning the stopcock and removing the cork to start the flow was varied. These variations produced no noticeable effect.

Most runs were made using 23 beakers. Several beakers, usually five, were selected from the group of beakers and weighed. This gave the quantity of liquids in these beakers, which usually agreed within 7%. The average content of these five beakers was considered to be the content of each beaker. The saving in time and evaporation losses was considered to justify such a procedure. The contents of each beaker were titrated with $AgNO_3$ using K_2CrO_4 as the indicator, to determine the salt content, from which the compositions in terms of the leading fluid were computed.

Errors

Temperatures of the fluids were read to 1° F., on a mercury-glass thermometer, and are accurate within 2° F. This corresponds to a maximum error of 3% in the viscosity or Reynolds number. The titrations were sensitive to contaminations of 1% of the salt solution in the pure water.

Table I—Theoretical Contamination in Viscous Flow

Range in Instantaneous Composition while Collecting Contaminated Portion in % by Vol. of Leading Fluid	Volume of Contaminated Portion in % of Total Pipe Volume	Average Composition of Contaminated Portion Expressed as % Leading Fluid
60%-40%	14.5%	49.0%
70-30	31.5	45.8
80-20	55.8	40.0
90-10	105.3	30.0
95- 5	172.3	21.8
98- 2	303.0	14.0

Table II—Experimental Data on Salt Solution and Water

Tube Diameter = 0.79 cm. (0.313 inches)
Length = 627 cm. (20.56 feet)
Volume of Tube = 310.5 cc.
Run No. 62
Total Elapsed Time for 23 Beakers = 6.1 sec.
Temperature (leading fluid) = 77° F.
Temperature (following fluid) = 77° F.

Beaker No.	Volume of Sample — cc.	Composition of Sample % Leading Fluid
1	10.33	98.5
2		spilled
3		100.3
4		100.2
5		100.0
6	10.38	95.4
7		76.7
8		45.8
9		22.0
10		10.6
11		5.12
12	10.30	2.92
13		0.73
14		0.37
15		0
16		0
17		0
18	10.34	0
19		0
20		0
21		0
22	10.45	0
23		0

Average Vol. = 10.36

Probably the greatest error is in measuring the quantities of contaminated material leaving the end tube. Spillage in flowing into the beakers, and variations in the diameters of the beakers introduced errors of about 3 and 4% respectively. Except in those few runs when the samples may have been collected before the beaker carriage attained uniform speed, the error is probably about 7% in the quantity of contaminated material and 3% in Reynolds number. This estimate is confirmed by the fact that most of the data points agree within 10% of the leveled data as represented by the curves in Figs. 3 to 9.

Results

The observed data for each run were recorded as indicated in Table II for Run 62. The average volume in each beaker was 10.36 cc. The average composition of each beaker was plotted over a volume increment of 10.36 cc., and the differential curve of instantaneous compositions was then drawn as shown in Fig 2. Velocity was calculated using the quantity of liquid collected and the time for collection. (23 × 10.36) or 238 cc. were collected in 6.1 seconds; thus the velocity $= \frac{20.56 \times 238}{310.5 \times 6.1}$ = 2.58 ft./sec. since the volume of the 20.56-ft. glass tube was 310.5 cc. At 77° F. the viscosity of water and the dilute salt solution is 0.90 centipoises. Thus the Reynolds number is

$$\frac{0.313 \times 62.4 \times 2.58}{12 \times 0.000672 \times 0.90} = 6940.$$

The mixed or contaminated portion is the volume of the mixture, collected between the indicated instantaneous composition limits, expressed as a percentage of the total pipe volume. For example, the

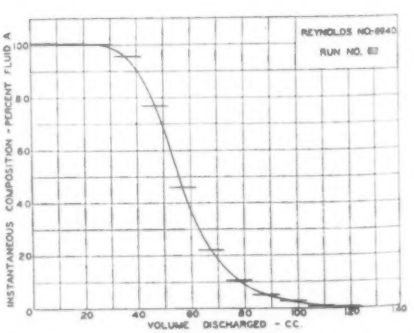

Fig. 2—Instantaneous composition of fluid discharging from end of pipe line plotted against the volume of the total fluid discharged

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Graphs Show Contaminated Portion in Per Cent of Pipe Volume

Fig. 3
DIAM. = 0.313 in.
LENGTH = 4.97 ft.
VOLUME = 19.3 cc.
L/D = 191

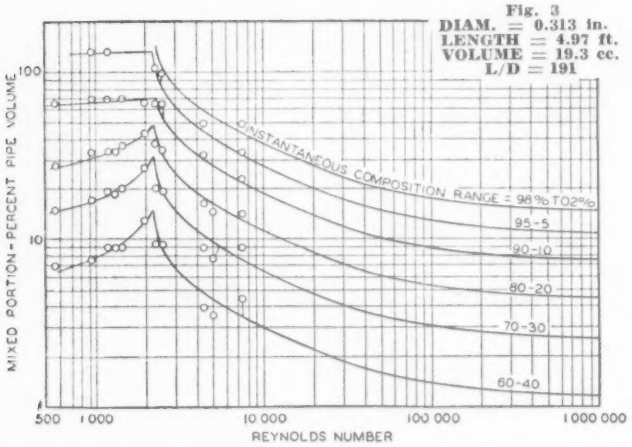


Fig. 4
DIAM. = 0.313 in.
LENGTH = 10.31 ft.
VOLUME = 156 cc.
L/D = 396

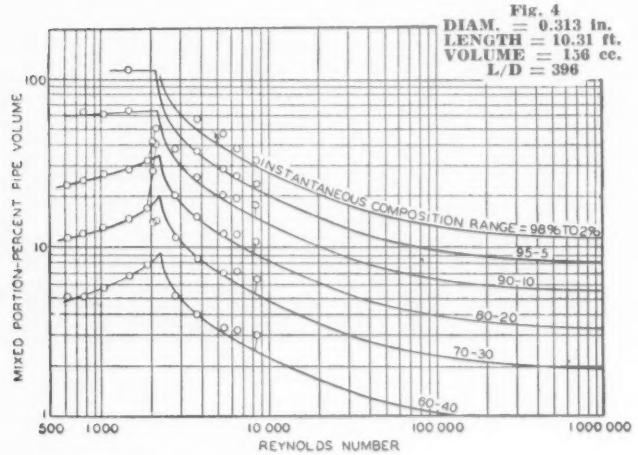


Fig. 5
DIAM. = 0.313 in.
LENGTH = 15.56 ft.
VOLUME = 235 cc.
L/D = 598

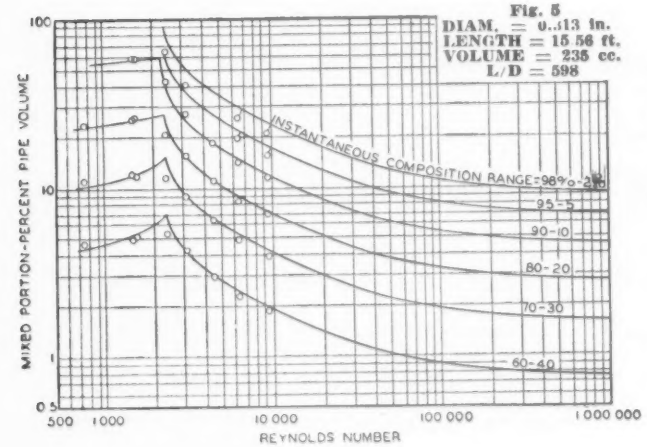


Fig. 6
DIAM. = 0.313 in.
LENGTH = 20.56 ft.
VOLUME = 310 cc.
L/D = 790

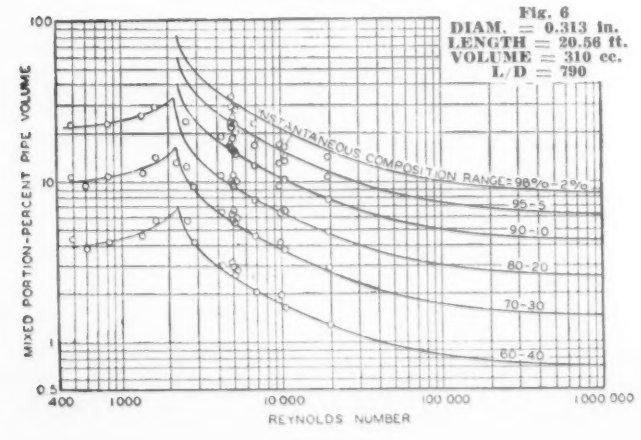


Fig. 7
DIAM. = 0.124 in.
LENGTH = 22.00 ft.
VOLUME = 52.2 cc.
L/D = 2130

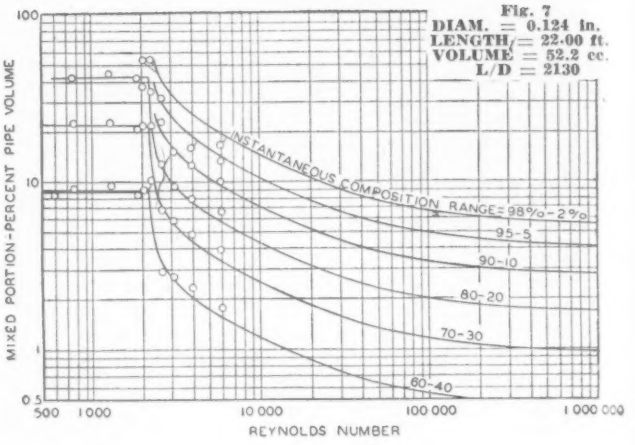


Fig. 8
DIAM. = 0.124 in.
LENGTH = 50.25 ft.
VOLUME = 119 cc.
L/D = 4860

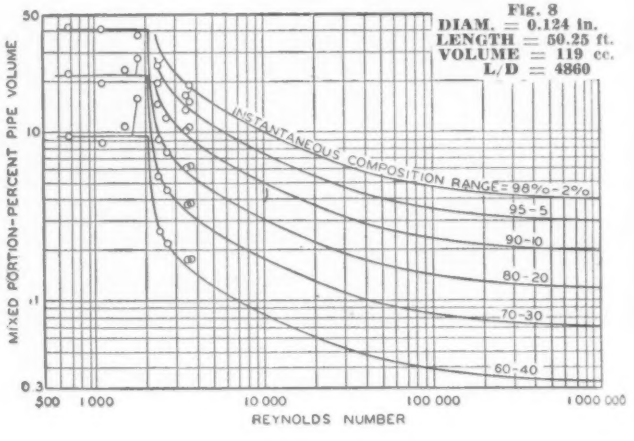
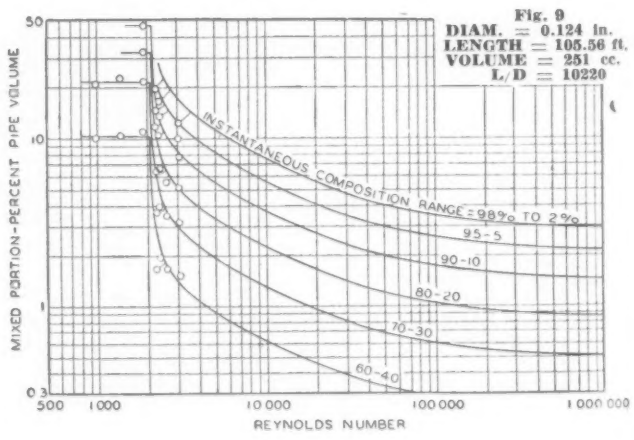


Fig. 9
DIAM. = 0.124 in.
LENGTH = 105.56 ft.
VOLUME = 251 cc.
L/D = 10220



Legend for Figs. 3-9

Figs. 3 through 9: The contaminated portion expressed as a percentage of entire pipe volume plotted as a function of Reynolds number. Each line represents the volume of contaminated portion collected between the instantaneous composition range indicated

Table III—Experimental Results

Run No.	Velocity (ft./sec.)	Reynolds Number	60-40% Mixed Portion (%)	70-30% Mixed Portion (%)	80-20% Mixed Portion (%)	90-10% Mixed Portion (%)	95-5% Mixed Portion (%)	98-2% Mixed Portion (%)
Diameter = 0.313 inches, L/D = 191, Viscosity = 0.90 centipoises								
137	0.214	577	6.93	14.9	27.6	65.3	.	.
127	0.353	951	7.47	17.1	32.9	68.0	132	.
126	0.440	1186	8.94	19.2	33.6	68.0	131	.
134	0.495	1334	8.80	18.7	33.3	.	.	.
135	0.537	1450	8.94	20.0	36.0	68.8	.	.
136	0.732	1970	12.80	26.7	42.4	66.1	.	.
128	0.854	2300	9.34	20.4	37.6	63.8	104.7	.
129	0.940	2540	9.34	19.2	34.0	63.7	98.0	.
132	1.645	4430	3.87	8.80	16.28	32.0	49.4	.
131	1.870	5040	3.46	7.60	14.67	27.2	.	.
133	2.80	7530	4.40	8.93	14.00	22.9	33.2	49.2
Diameter = 0.313 inches, L/D = 396, Viscosity = 0.90 centipoises								
111	0.234	630	5.14	11.6	23.8	.	.	.
110	0.294	792	5.14	12.2	25.1	63.7	.	.
124	0.389	1048	5.73	13.1	27.6	62.1	.	.
112	0.553	1490	6.76	15.0	29.1	66.5	114.4	.
125	0.711	1913	7.92	17.1	32.8	.	.	.
122	0.766	2060	14.1	28.2	45.2	.	.	.
113	0.805	2170	14.5	41.3	51.8	.	.	.
115	1.04	2800	5.14	11.58	20.6	38.4	.	.
116	1.41	3800	3.99	8.62	15.12	26.2	37.6	58.2
117	2.02	5440	3.35	7.07	12.15	20.8	29.4	47.7
118	2.44	6570	3.22	7.14	11.90	19.5	26.6	38.7
119	3.21	8630	3.02	6.42	10.80	17.75	23.8	32.8
Diameter = 0.313 inches, L/D = 598, Viscosity = 0.90 centipoises								
109	0.0653	176	3.41	7.66	.	.	.	.
100	0.281	757	4.68	11.08	23.4	.	.	.
103	0.550	1480	4.95	12.09	25.6	59.6	.	.
99	0.573	1542	5.15	11.63	26.1	59.2	.	.
102	0.872	2350	5.37	11.40	20.7	43.5	66.1	.
107	1.15	3090	4.22	8.95	15.44	27.5	40.7	.
104	1.658	4470	2.99	6.52	11.10	18.32	.	.
105	2.33	6280	2.26	4.87	8.27	14.08	19.65	26.0
108	3.49	9380	1.877	3.92	7.03	11.42	15.79	21.1

Table III-A—Experimental Results

Run No.	Velocity (ft./sec.)	Viscosity (Centipoises)	Reynolds Number	60-40% Mixed Portion (%)	70-30% Mixed Portion (%)	80-20% Mixed Portion (%)	90-10% Mixed Portion (%)	95-5% Mixed Portion (%)	98-2% Mixed Portion (%)
Diameter = 0.313 inches, L/D = 790, Viscosity = 0.90 centipoises									
94	0.182	. . . .	490	4.34	10.47	22.1	. . . .	. . . .	. . . .
93	0.228	. . . .	614	3.76	9.30	.	. . . .	. . . .	. . . .
96	0.310	. . . .	834	4.15	10.72	22.6	. . . .	. . . .	. . . .
97	0.507	. . . .	1365	4.44	11.20	25.3	. . . .	. . . .	. . . .
61	0.617	. . . .	1660	5.60	13.90	28.7	. . . .	. . . .	. . . .
60	0.838	. . . .	2250	12.9	.	.	. . . .	. . . .	. . . .
59	0.972	. . . .	2610	5.63	12.23	23.0	. . . .	. . . .	. . . .
58	1.07	. . . .	2880	4.08	9.02	.	. . . .	. . . .	. . . .
56	1.59	. . . .	4300	2.96	6.32	10.82	18.67	. . . .	. . . .
52	1.84	. . . .	4960	3.06	6.12	9.92	16.09	23.0	33.5
49	1.88	. . . .	5070	2.87	5.63	9.66	15.64	21.4	28.4
47	1.89	. . . .	5090	2.96	6.42	10.75	18.22	24.8	. . . .
51	1.93	. . . .	5190	2.54	5.34	9.14	15.05	22.2	. . . .
54	1.97	. . . .	5300	2.74	5.80	9.43	14.68	20.0	27.4
55	1.97	. . . .	5300	2.77	5.83	9.88	. . . .	. . . .	. . . .
62	2.58	. . . .	6940	2.00	4.42	7.47	12.24	16.60	22.7
66	3.69	. . . .	9910	1.93	4.02	6.22	9.14	12.75	16.25
67	3.95	. . . .	10620	1.61	3.64	6.32	10.05	13.20	16.10
98	7.35	. . . .	19800	1.26	2.80	4.77	7.50	10.38	13.82
Diameter = 0.124 inches, L/D = 786									
185	1.11	1.115	957	11.4	23.4	43.0	99.5	228	306
187	3.64	0.814	4290	4.16	8.30	14.0	21.3	28.0	35.8
186	4.72	0.938	4830	4.16	8.82	14.0	20.2	24.9	29.6
Diameter = 0.124 inches, L/D = 2130									
181	0.606	1.002	580	8.25	. . . .	. . . .	. . . .	. . . .	. . . .
183	0.683	0.866	758	9.02	22.3	41.6	. . . .	. . . .	. . . .
180	1.39	1.071	1250	9.40	22.1	44.2	. . . .	. . . .	. . . .
184	1.66	0.878	1820	8.25	20.2	40.9	. . . .	. . . .	. . . .
178	1.89	0.925	1970	8.81	21.1	36.5	52.8	. . . .	. . . .
179	1.87	0.814	2200	10.17	21.1	34.1	52.9	. . . .	. . . .
177	2.17	0.823	2530	2.88	6.72	12.62	22.4	31.1	37.6
176	2.49	0.803	2980	2.68	5.75	9.21	14.80	. . . .	. . . .
175	3.14	0.795	3790	2.30	4.80	7.87	12.30	15.7	. . . .
173	5.17	0.878	5650	1.73	3.84	6.52	9.98	13.1	16.3
Diameter = 0.124 inches, L/D = 4860									
198	1.11	1.505	710	9.50	22.3	42.3	. . . .	. . . .	. . . .
201	1.56	1.347	1115	8.63	19.7	41.2	. . . .	. . . .	. . . .
202	1.96	1.251	1510	10.83	23.7	. . . .	. . . .	. . . .	. . . .
203	2.44	1.291	1820	15.9	27.5	37.9	. . . .	. . . .	. . . .
206	3.45	1.392	2380	2.60	5.45	9.05	14.75	19.6	24.9
207	3.97	1.430	2670	2.18	4.53	7.63	12.10	. . . .	. . . .
208	4.03	1.109	3500	1.76	3.69	6.20	10.14	13.6	16.6
209	4.63	1.214	3670	1.76	3.77	6.28	10.70	15.1	18.9
Diameter = 0.124 inches, L/D = 10220									
194	1.17	1.154	975	10.0	20.8	. . . .	. . . .	. . . .	. . . .
188	1.47	1.030	1372	10.43	22.5	. . . .	. . . .	. . . .	. . . .
191	2.05	1.050	1875	10.95	21.5	32.2	46.3	. . . .	. . . .
192	2.45	1.063	2220	1.67	3.63	6.37	11.64	14.55	19.40
195	2.21	0.918	2320	1.95	3.94	6.50	10.25	13.42	16.55
197	2.74	1.030	2560	1.67	3.46	5.43	. . . .	. . . .	. . . .
196	3.04	0.962	3040	1.51	3.11	5.02	7.65	9.96	12.10

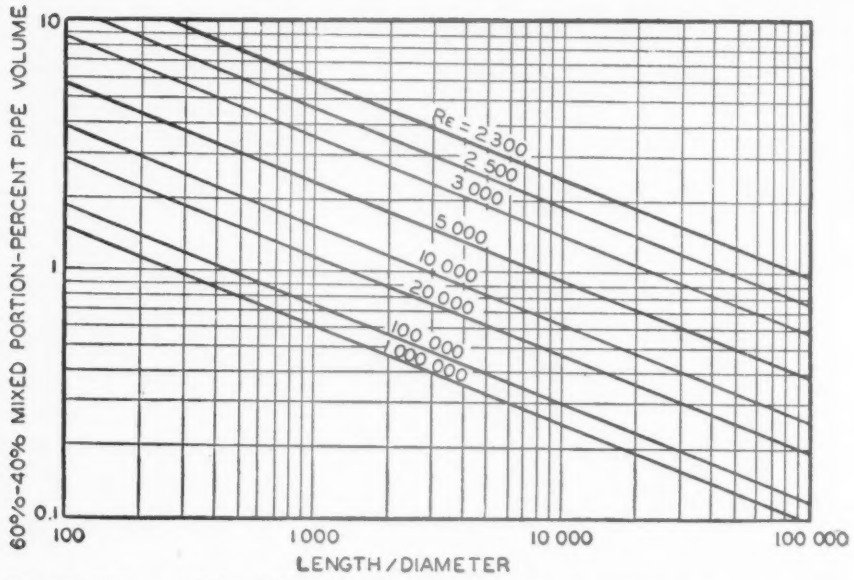


Fig. 10—Volume of the 60%-40% contaminated portion expressed as a per cent of total pipe volume plotted against the ratio of length divided by diameter of the pipe for various values of Reynolds number from 2300 to 1,000,000

expression 98%-2% mixed portion is the volume of mixture that flowed from the pipe during the time that the composition changed from 98% leading liquid to 2% leading liquid, expressed as per cent of the total volume of the pipe.

The 98%-2% mixed portion for Run No. 62 is calculated from Fig. 2. The volume between compositions of 98% and 2% leading liquid was equal to 70.5 cc. Since the total volume of the tube was 310.5 cc., the 98%-2% mixed

$$\text{portion} = \frac{70.5}{310.5} = 22.7\% \text{ of the tube}$$

volume. Similarly the mixed portion was calculated for other composition changes such as 60%-40%, 70%-30%, etc.

Experimental results are summarized in Table III. In all runs except Run 55 the salt solution is the leading fluid.

EFFECT OF DIAMETER, LENGTH, VELOCITY, AND VISCOSITY

The contaminated portions for the various composition changes are plotted against the Reynolds number for each particular tube in Figs. 3-9, which give graphically the effect of diameter, velocity, and viscosity on the quantity of the contaminated portion. In the turbulent region these curves are parallel and clearly indicate that an increase in Reynolds number causes a decrease in the contaminated portion.

The curves were drawn through the experimental data on salt solution and water for Reynolds numbers up to 20,000, and were extended to Reynolds numbers of 1,000,000 using commercial data.[9]

In the viscous region theory and experimental data on the longer tubes shows that the contaminated portion does not vary with Reynolds number. The apparent increase in the contaminated portion with Reynolds number in the short tubes is attributed to the greater influence of end effects in these tubes.

In all cases the quantity of the contaminated portion is most sensitive to the Reynolds number in the turbulent region near the critical value of about 2200.

Allowing the two liquids to remain in stationary contact with each other before flowing through the tube had no effect on the amount of contaminated portion. Because of the similarity in physical properties of the water and salt solutions, the amount of contaminated portion is the same whether the salt solution of water is the leading fluid. With fluids of dissimilar physical properties this would probably not be the case.

When the contaminated portions for the same change in instantaneous composition in turbulent flow are plotted versus the ratio of length to diameter of the pipe $\left(\frac{L}{D}\right)$, a series of straight lines, having a slope of negative 0.4 are obtained (Fig. 10) for each Reynolds number.

The equation of these lines is

$$\log_{10}\left(\frac{\text{Vol. of Contam. Portion}}{\text{Volume of Pipe}}\right) = C - 0.4 \log_{10}\left(\frac{L}{D}\right) \quad \ldots\ldots (19a)$$

or

$$\log_{10}(\text{Contaminated Portion}) = \log_{10}(\text{Pipe Vol.}) - 0.4 \log_{10}\left(\frac{L}{D}\right) + C \quad \ldots\ldots (19)$$

in which C is a function of the Reynolds number and the range in instantaneous composition covered by the contaminated portion.

Values of C for use in Equation (19) for turbulent flow are given in Table IV and plotted in Fig. 11, as a function of Reynolds number and range in instantaneous composition.

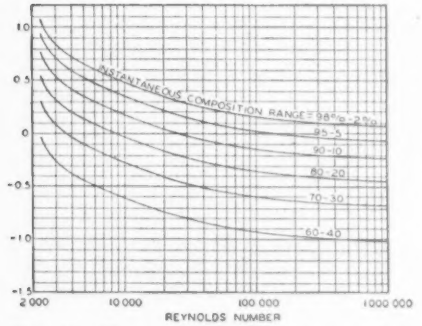


Fig. 11—The values for the factor C to be used in connection with equation (19) plotted as a function of Reynolds number for determining the contaminated portion between the indicated instantaneous composition range

DISCUSSION

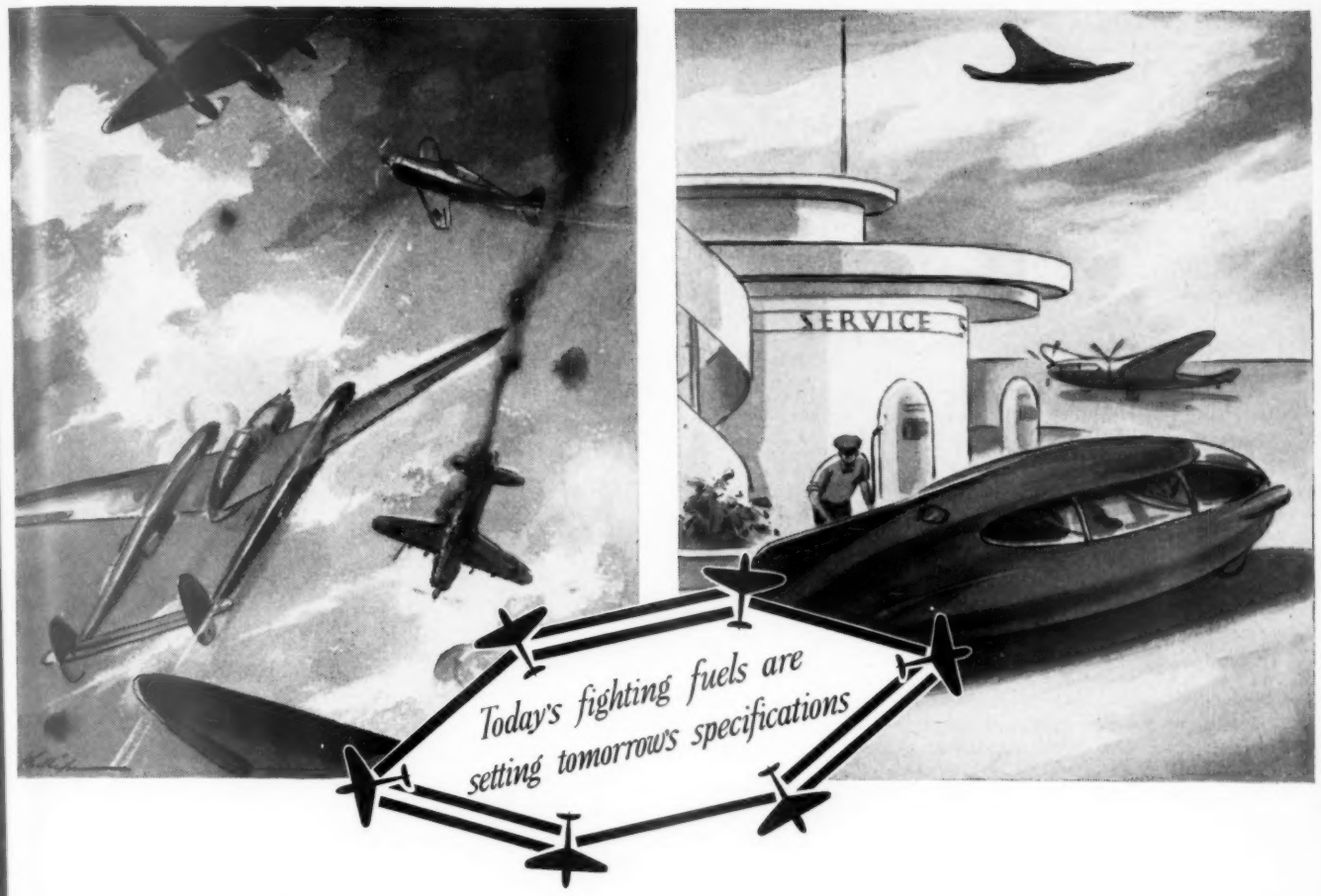
In comparing the experimental results in the region of laminar flow (Reynolds number less than 2100), Figs. 3-9, with the theoretical quantities of contaminated portion computed for ideal laminar flow as listed in Table I, it is observed that the experimental contaminated portion in the longer pipes is independent of Reynolds number as indicated by the theoretical considerations, although the numerical value is somewhat less, being about 70% of the theoretical. In the shorter tubes, where end effects are of greater significance, the experimental contaminated portion is not independent of Reynolds number and the numerical value differs even more from the theoretical, being about 50% of the latter.

As has been indicated, both theoretically and experimentally, any increase in the turbulence of flow tends to decrease the contaminated portion. It is known that an appreciable time or distance is required to establish true laminar flow. Therefore, the cause for the experimental contaminated portion being less than the theoretical in laminar flow is probably incidental turbulence, or mixing, and end effects.

The work to date has been limited to two successive fluids of identical kinematic viscosity. Lacking any information on the effect of differences in the viscos-

Table IV—Values of Factor C To Be Used in Equation (19)

Reynolds Number	Instantaneous Composition Ranges in Per Cent Leading Fluid					
	60-40	70-30	80-20	90-10	95-5	98-2
2300	—0.02	0.31	0.55	0.77	0.94	1.07
2500	—0.13	0.20	0.44	0.66	0.83	0.96
3000	—0.25	0.08	0.32	0.54	0.71	0.84
5000	—0.44	—0.11	0.13	0.35	0.52	0.65
10000	—0.61	—0.28	—0.04	0.18	0.35	0.48
20000	—0.74	—0.41	—0.17	0.05	0.22	0.35
50000	—0.87	—0.54	—0.30	—0.08	0.09	0.22
100000	—0.93	—0.60	—0.36	—0.14	0.03	0.16
500000	—1.01	—0.68	—0.44	—0.22	—0.05	0.08
1000000	—1.02	—0.69	—0.45	—0.23	—0.06	0.07



Cycloversion

FOR SUPERIOR AVIATION BASE STOCK

This new catalytic process enables small or large refiners to make a superior base stock for aviation gasoline from cracked naphtha. Cycloversion effects an unusually complete conversion to aromatic hydrocarbons in the gasoline boiling range and has the further advantage of being very efficient; that is, the by-products are largely valuable alkylating agents and high octane motor fuels.

ECONOMICAL CONVERSION OF PRESENT PLANTS

Present thermal cracking units can be used for Cycloversion with the addition of catalyst chambers and catalyst reactivating equipment. Cycloversion units can be designed to fit either small or large plants. Because Cycloversion is extremely flexible, a refinery so equipped can use a wide variety of charging stocks and can produce products in greatest demand at any particular time.

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ity of the two fluids, the contaminated portion may be estimated by averaging the kinematic viscosities (or Reynolds numbers) of the two fluids for use in Equation (19) or the corresponding charts.

Commercial Application

The contaminated portion in commercial petroleum product pipe lines is an important consideration in their construction and operation. The laboratory data reported in this paper are limited to contamination of two products of the same physical properties. Somewhat different relationships are to be expected when dealing with the contamination of dissimilar fluids. However, it appears that the use of Equation (19) with the average Reynolds number of the two fluids approximates the contamination in commercial pipe lines as indicated in Table V within the indicated error in sampling and analyzing the oil samples.

Samples were withdrawn from the flowing oil stream through a small tap on the pipe line, at 2-minute intervals for a period of about 10 to 15 minutes, and analyzed by the pipe line operators to the extent of taking A.P.I. gravities by hydrometers. This leaves complete uncertainty as to the range of instantaneous compositions of the stream in the pipe line for a contaminated portion and thus the ranges of 98%-2% and 95%-5% chosen as the basis of comparison must be regarded as arbitrary in making the comparisons in Table V.

Sample Calculation

To estimate the volume of contaminated product discharged from a 10-inch diameter pipe line 100 miles in length when pumping a distillate of 37° *A.P.I.* and 7.0 centistokes (48.8 Saybolt seconds) viscosity followed by a kerosene of 43° *A.P.I.* and 3.0 centistokes (36.8 Saybolt seconds) viscosity at 40° F., the temperature of the fluid in the pipe line, when pumping 1500 barrels per hour.

$$\text{Pipe line } \frac{L}{D} = \frac{100 \times 5280 \times 12}{10} = 633{,}600$$

$$\text{Average kinematic viscosity} = \frac{7.0 + 3.0}{2} = 5 \text{ centistokes}$$

$$= 5 \times 0.00001076 = 0.0000538 \text{ sq. ft./sec.}$$

$$\text{Velocity} = \frac{1500 \times 42 \times 0.1337}{3600 \times 3.1416 \times \left(\frac{5}{12}\right)^2}$$

$$= 4.28 \text{ ft./sec.}$$

$$\text{Av. Reynolds No.} = \frac{D\bar{u}}{\nu}$$

$$= \frac{10 \times 4.28}{12 \times 0.0000538} = 66300$$

$$\text{Volume of Pipe} = 3.1416 \times \left(\frac{5}{12}\right)^2 \times \frac{100 \times 5280}{42 \times 0.1337} = 51{,}300 \text{ bbls.}$$

$$\log_{10}(\text{Contam. Portion}) = \log_{10}(\text{Pipe Vol.}) - 0.4 \log_{10}\left(\frac{L}{D}\right) + C \qquad (19)$$

For Rey. No. of 66,300 and 98%-2% mixed portion, from Fig. 11 $C = 0.19$

$\log$ (Contam. Portion $= 4.710 -$ $0.4\ (5.802) + 0.19 = 2.579$

98%-2% Contam. Portion = 380 bbls.

Similarly for 95%-5% mixed portion, $C = 0.06$

95%-5% Contaminated Portion = 281 bbls.

ACKNOWLEDGMENT

The suggestions and invaluable assistance of Mr. Sydney S. Smith and his associates in the Products Pipe Line Department of the Shell Oil Co. are gratefully acknowledged.

NOMENCLATURE

- A = leading fluid of two fluids flowing successively through a pipe
- B = following fluid of two fluids flowing successively through a pipe
- D = inside diameter of pipe (feet)
- L = distance over which the two fluids flow successively (feet)
- r = inside radius of pipe (feet)
- s = specific gravity of fluids
- t = time starting when the two fluids begin their successive flow (seconds)
- u = velocity of fluid at distance y from center of pipe (ft./sec.)
- $\bar{u}$ = average velocity of flow (ft./sec.)
- u_{max} = velocity of fluid at center of pipe (ft./sec.)
- V = volume of fluid discharging from pipe (cubic feet)
- X = inlet station
- x = composition of mixture — volume of fluid A in sample ÷ total volume of sample
- Y = station at distance L from station X
- y = distance a point is from center of pipe (feet)
- ρ = density (lbs./cu.ft.)
- μ = viscosity (lb./sec.ft.)
- ν = kinematic viscosity (sq.ft./sec.)
- "98-2 mixed portion" = volume of liquid discharging from pipe while the composition changes from 98% A to 2% A

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Table V—Commercial Data Obtained on a Products Pipe Line of 7.98 Inches Diameter

(The error in the reported volume of contaminated product is apparently large. For example, in tender 3 the contaminated portion at station 1 is 20% greater than the reported contaminated portion at station 2. This and other discrepancies may be due in part to the lack of definition of the degree of contamination measured, as well as the obvious errors in sampling.)

Tender	A.P.I. Leading Fluid	A.P.I. Following Fluid	Viscosity, Centistokes Leading Fluid	Viscosity, Centistokes Following Fluid	Average Rate bbls./hr.	Average Reynolds Number	Reported Volume Contam. Product	Volume Computed 98 2	Volume Computed 95 5
Station 1, $\frac{L}{D} = 437{,}000$									
1	63.8	78.0	0.64	0.51	950	468,000	114	122	88.6
2	78.0	72.5	0.51	0.67	940	453,000	96.3	123	89.2
3	72.5	78.0	0.67	0.505	1000	481,000	134.5	120	88.1
4	78.0	62.7	0.505	0.635	1060	522,000	101	119	87.2
5	42.7	36.5	3.31	5.63	946	62,700	126	159	116
6	36.5	42.7	5.61	3.30	946	62,800	120	159	116
7	36.5	43.6	7.20	2.90	871	59,100	123	162	118
8	42.7	36.5	3.30	7.20	885	54,700	120	165	120
9	78.1	71.7	0.525	0.695	620	288,000	101	126	92.3
10	42.5	36.9	3.15	5.30	958	67,300	128	155	115
11	62.1	42.5	0.645	3.13	958	298,000	160	129	94.4
12	36.9	42.5	5.30	3.15	952	66,900	129	155	115
13	42.5	36.6	3.15	6.75	953	61,500	129	160	117
14	36.6	42.5	6.70	3.15	944	61,000	92	160	117
15	42.5	63.0	3.15	0.645	934	242,000	272	129	94.4
16	63.6	77.7	0.65	0.51	1116	544,000	113	119	87.5
17	77.7	72.0	0.51	0.68	1117	531,000	150	119	87.5
18	72.0	77.7	0.675	0.51	1121	537,000	145	119	87.5
Station 2, $\frac{L}{D} = 910{,}000$									
1	63.8	78.0	0.64	0.51	890	435,000	185	191	138
2	78.0	72.5	0.51	0.67	900	430,000	112	191	138
3	72.5	78.0	0.67	0.505	1030	493,000	112	188	137
4	78.0	62.7	0.505	0.635	1080	532,000	148	186	136
5	42.7	36.5	3.31	5.63	946	62,800	150	246	178
6	36.5	42.7	5.61	3.30	946	62,300	180	246	178
7	36.5	43.6	7.20	2.90	718	47,800	160	260	191
8	42.7	36.5	3.30	7.20	894	54,200	152	255	184
9	78.1	71.7	0.525	0.695	687	316,000	130	193	143
10	42.5	36.9	3.15	5.30	948	66,300	119	240	180
11	62.1	42.5	0.645	3.13	952	247,000	215	200	146
12	36.9	42.5	5.30	3.15	942	66,000	152	240	180
13	42.5	36.6	3.15	6.75	942	60,700	153	248	182
14	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...
16	63.6	77.7	0.65	0.51	1118	519,000	149	186	136
17	77.7	72.0	0.51	0.68	1118	531,000	112	186	136
18	72.0	77.7	0.675	0.51	1121	533,000	150	186	136
Station 3, $\frac{L}{D} = 1{,}353{,}000$									
1	63.8	78.0	0.64	0.51	1000	488,000	186	238	174
2	78.0	72.5	0.51	0.675	1010	533,000	222	237	173
3	72.5	78.0	0.68	0.51	1020	485,000	224	238	174
4	78.0	62.7	0.51	0.645	1040	505,000	335	237	173
5	42.7	36.5	3.35	5.70	946	61,900	211	313	230
6	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...
8	42.7	36.5	3.35	7.40	823	49,400	205	332	244
Station 4, $\frac{L}{D} = 1{,}765{,}000$									
1	63.8	78.0	0.64	0.51	1010	489,000	293	275	202
2	78.0	72.5	0.51	0.675	1020	483,000	336	275	202
3	72.5	78.0	0.68	0.51	1060	501,000	262	274	200
4	78.0	62.7	0.51	0.645	1080	524,000	412	274	200
5	42.7	36.5	3.35	5.70	883	57,800	331	372	272
6	...	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...	...

DIESEL PROGRESS In Rail Transportation*

The development of Diesel-electric locomotives in rail service is described from the point of view of a railroad operator. Many problems were encountered in adjusting the operation of these prime movers to high speed passenger service on existing trackage. Progress is being made with Diesel-electrics in yard switching service and they are also now challenging the steam locomotive in freight hauling.

By E. F. Weber**

ALMOST everyone has witnessed a modern streamline train in action. You first notice a speck of stainless steel emerging from the distant haze. In spectacular fashion it flashes by, a mass of shimmering steel, at 100 miles an hour and within a course of seconds vanishes again into the distance.

These sights are so commonplace today that little thought is given to the short space of time that has elapsed in the evolution of this class of rail transportation. The Diesel engines used in powering many of the high-speed streamline trains over the rails today had their origin in the General Motors exhibit at the Century of Progress in Chicago in 1933. A pair of them there furnished current for the exhibit. It was then that the Burlington management conceived the idea of adopting a Diesel engine for rail motive power. This idea resulted in the birth and development of the original "Pioneer Zephyr", completed in April, 1934. After an extensive exhibition tour over the country, it was placed in regular service Nov. 11, 1934, between Lincoln, Omaha, and Kansas City. This was the first streamline train powered with a Diesel engine to operate in this country. Up to the present there are in excess of 130 Diesel-electric powered trains in service in this country.

The Burlington Lines now operate 18 Diesel-electric locomotives in passenger service which represent a total of 45,000-horsepower and cover over 13,000 miles daily. The Denver Zephyrs run off 1036 miles daily and are in continual operation more than 16 hours out of every 24. The Twin Cities Zephyrs each make a round trip between Chicago and Minneapolis daily, a total of 874 miles. Train No. 21 leaving Chicago at 9 a.m. arrives in Minneapolis at 3:45 p.m. This same train again leaves Minneapolis as Train No. 24 at 4 p.m. During one quarter hour, passengers and baggage must be unloaded, train turned on a wye, and promptly moved to the maintenance pit. The engine must be refueled and the cars watered and stocked with commissary supplies. The entire outside surface of stainless steel and windows are cleaned, the interior is vacuumed, and a close inspection of power plant, trucks, wheels and air brakes is made to make sure the train is in proper and safe running condition before it leaves the terminal. The train is then returned to the station, passengers and baggage again loaded, departing all within the quarter hour.

Train No. 21 covers the distance of 427 miles, Chicago to St. Paul, in 6¼ hours at an average speed of 68.32 miles per hour including 8 intermediate stops. From East Dubuque to Prairie du Chien this train holds the world's record. The 54.61 miles between these two points is covered in 38 minutes from start to stop or an average speed of 86.22 miles per hour.

Faster and More Comfortable

Before the advent of the Diesel in rail transportation, 50 miles per hour was considered a high average speed in passenger service. Comparing it with the average speeds of the modern streamline trains today we find that great strides have been made in presenting to the public a faster and more comfortable mode of transportation. Five hundred miles was formerly considered the average overnight run; it has now been extended to over 1000 miles. One can now leave Chicago any night at 5:30 p.m. and be in Denver the next morning for breakfast, which is a most dramatic railroad achievement.

The modern steam locomotive of today, although its outward appearance seems to be unchanged, has undergone developments and improvements to keep pace with the times. Its high speeds are comparable with those of the Diesel-electric, but to sustain these high speeds month after month has required many technical changes. Side rods have been lightened, and roller bearings have been applied. These improvements have helped con-

*Presented before Oil and Gas Power Division, American Society of Mechanical Engineers, New Orleans, April 30, 1943.

**General Superintendent of Automotive Equipment, Burlington Lines.

siderably to reduce the unbalanced forces of the reciprocating assembly, although it has been impossible to eliminate them entirely.

Dynamic augment, that impact or force imparted into the rail with every revolution of main drivers at the higher speeds, may be of such magnitude as to bend or kink the rails. In a wheel slippage test conducted on the Burlington 2 years ago we proved conclusively through slow slow-motion pictures that, due to the unbalanced reciprocating motion at speeds in excess of 90 miles per hour, the unbalanced condition on certain locomotives was sufficient to raise the main drivers an inch or more off the rail thereby projecting damaging impacts into the track structure at these higher speeds. In the case of steam locomotives we have reduced these impacts by better counterbalancing of drivers. Diesel-electric power is much easier on the track because its tractive power is applied through electric motors by a uniform, constant torque, rather than by reciprocating motion, thereby entirely eliminating dynamic augment.

Refueling Takes Longer

A further disadvantage to the steam locomotive is the fact that it requires approximately 45 minutes standing time for fueling, watering, and miscellaneous

A Diesel-electric switch engine in service on the Burlington lines

work between Chicago and Denver. In order to maintain schedule time, this 45 minutes must be made up on an already fast schedule.

The modern steam locomotive, having approximately a 20-inch higher center of gravity above the rails than a Diesel locomotive, must be subject to a 10-mile-per-hour greater restriction on most curves. These are some reasons why Diesel power was chosen for the difficult schedules: Diesels do not need long or frequent servicing enroute and can thus make the fast time required without running at excessive speeds, thereby making possible the fastest overall schedule with the lowest possible maximum speed. This is the ultimate goal.

Speed Qualifications

All creations since the beginning of time have had their share of criticism during their course of development, and Diesel-electric power in rail transportation has not been an exception. Remarks are often heard that the steam locomotive has unlimited speed. This is true, but if the increased maintenance cost of the track and locomotive, together with the availability of the unit are considered, then the practicability of the steam locomotive in sustained high speed service may be challenged. The speed of the Diesel unit is not in direct ratio with the revolutions per minute of the prime mover. In starting, the train may only be moving 10 miles per hour while the Diesel engine may be turning over at its full rated revolutions per minute. On the other hand, this train may be cruising along at 100 miles per hour while the prime mover may be in idling position. Therefore, so far as the prime mover is concerned, the speed of the Diesel-electric locomotive is limited only by the allowable peripheral speed of the traction motor armatures.

Sometimes we hear remarks about the difficulty of walking through aisles of a streamline train when rounding curves at high speed, a difficulty not experienced on the conventional trains. An attempt to reduce centrifugal force would indeed require a defiance of the laws of nature with either type of train.

Back in the early days of Diesel power development, when the largest streamline unit available was a three-car train powered with a 660 h.p. Diesel, an occasional failure necessitated the substitution of steam power which averaged about 4000 h.p. Even though this much power had some difficulty in maintaining the Diesel schedules, there were proud moments among the supporters of steam locomotives when these engines pulled their train into the terminal on time. Then larger Diesel power came into the picture, 10- and 12-car trains powered with 3000 h.p. units, and when steam power was substituted, it was more difficult to reproduce Diesel service on scheduled time. During the past 5 years the Burlington has purchased one 1000-h.p., two 2000-h.p. and seven 4000-h.p. high speed Diesel road locomotives, thus setting another precedent in the definite progress of this type of rail equipment. Formerly this type of power was always purchased as part of a special train, but these 4000 h.p. Diesels were purchased as just so much motive power to supplant their predecessors—the steam locomotives. A short time ago one of these 4000-h.p. units, pulling the "Fast Mail" consisting of 17 conventionel cars, picked up 25 minutes from the schedule between Galesburg and Aurora, a distance of 124 miles. Such a feat would be difficult to perform with any other type of motive power on the rails today.

High Starting Torque

One strong argument often made against the Diesel electric prime-mover concerns the rapid drop of its tractive effort curve, compared with that of the steam locomotive. The peculiar characteristic of the electric drive produces a tractive effort curve starting somewhere in the direction of infinity. In the case of the 4000-h.p. unit it is approximately at 150,000 lbs., which is about twice that produced by a comparable steam locomotive. With this high starting torque, the curve can well afford to make a rapid drop and still be comparable with the curve developed by a steam locomotive of equal horsepower.

So far certain advantages that make the Diesel desirable for high speed road service have been cited. The remarkably high daily mileage developed by this equipment, however, together with the high per cent of availability in sustaining this mileage month after month, are the two most important fundamentals that will eventually and automatically solve the question as to what the ultimate future progress of the Diesel will be in meeting railway requirements.

From the inception of Diesel power up to and including Dec. 31, 1942, the Diesel high speed trains owned by the Burlington Lines produced a total of 28,080,195 miles, a performance which is outstanding because the majority of this mileage has been developed since 1937. In order to stress the remarkable performance of this equipment let us refer to Zephyr 9901, which was placed in service in April, 1935, as one of the first Twin Cities Zephyrs between Chicago and Minneapolis. In this service it covered 415,782 miles. It was then transferred to the Texas Lines, and from Sept. 30, 1936, to Dec. 31, 1942, ran 1,236,394 miles, a grand total of 1,652,176 miles. In 6 years on the Texas Lines this train actually ran 1,236,394 of the

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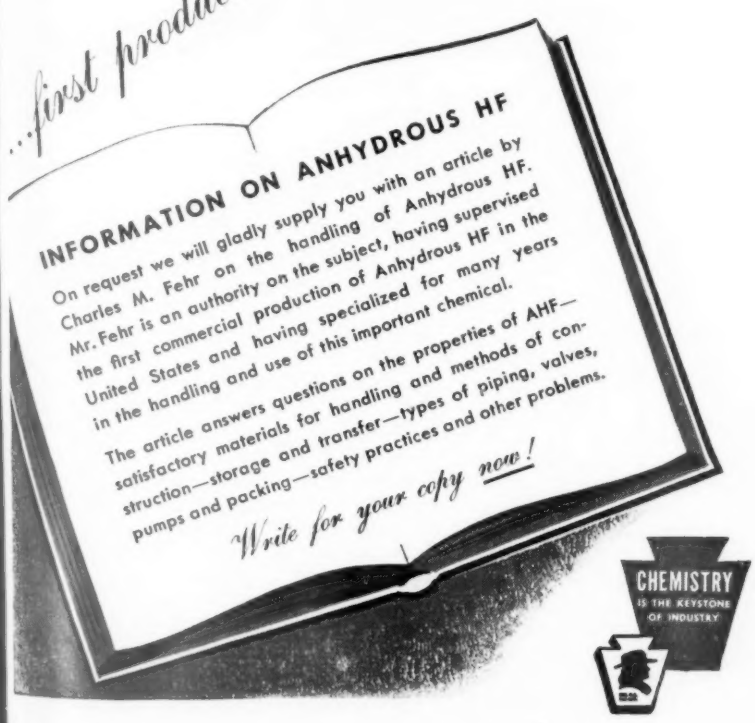
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1,291,324 miles assigned to it; in other words, it maintained a record of 95.75% availability. Surely such a remarkable performance could not be duplicated by a steam locomotive.

Inspection is Systematic

One of the prime factors in keeping these streamline trains in service is a highly coordinated maintenance personnel that has been specially trained for exacting requirements. Regular inspections and running repairs are made at the maintenance points during the lay-over period, which varies from 6 to 12 hours according to the length of the assigned run. One of the first duties of the engine maintenance personnel is to remove the air duct covers for inspection of the pistons and rings, which can be seen through the air scavenging ports in the cylinder liners. When it is found that a ring is tight in the groove or that a piston shows signs of blackening due to blow-by, the piston is removed for cleaning and new rings are applied if necessary. Since it is necessary to take off the cylinder head for removal of a piston, the head is thoroughly inspected, and the exhaust valves and guides are cleaned. All of the valve and injector rocker arm assemblies, automatic slack adjusters, valve springs, and so forth are carefully inspected each day for defects. Our experience indicates that by systematic inspections a thoroughly trained maintenance personnel can keep the power units in such good running condition that they can cover approximately 1,200,000 miles before it is necessary to send them to the shops for general repairs.

The two-cycle Diesel prime movers used in the Burlington streamline trains were the first of their kind in which the work load between cylinder head and crankshaft were tied together through a weld. The cylinder block and crankcase is of solidly welded construction in which full dependence is placed upon the welded joint. One of the outstanding developments in the fabricated structure is that rigidity has not been sacrificed. This point is of great importance because rigidity determines the life of the main bearings and the wear of all moving parts contained within the structure. Maintaining rigidity and reducing weight, however, are directly contradictory. To accomplish reduction in weight and still maintain rigidity, the sections must be carefully distributed in the most advantageous manner.

Mileage Limitations

Some time ago we became interested in what the mileage limitations of the major parts of the Zephyr-type Diesel engine would be. After considerable field research indications are that:

The rigid fabricated steel crankcase will render satisfactory service for at least 10,000,000 miles after which metal fatigue may be the limiting factor.

The crankshaft will not need to be reground before 1,200,000 miles service, after which it may be expected to go through another cycle of approximately the same mileage. With the Allison metal main crankshaft bearings now being used, the life should be extended to 800,000 miles and the connecting rod bearings at least 500,000 miles.

It is estimated that the life of cylinder liners will be about 1,000,000 miles, after which they should be reground and fitted with over-size pistons and rings.

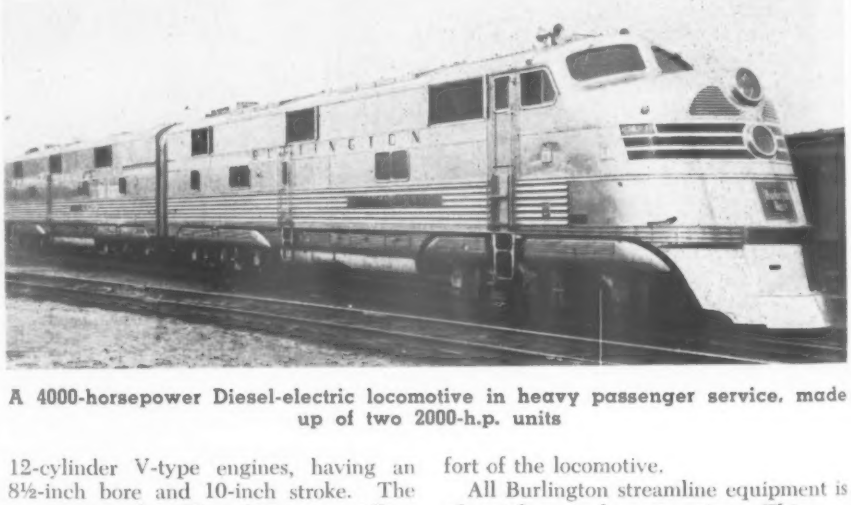
The type of pistons now used can be expected to produce at least 800,000 miles service before they are worn to the limit. The average life of the two top piston rings is 100,000 miles and for the remainder of the rings 200,000 miles.

Engine Specifications

The useful life of a cylinder head varies from 800,000 to 1,000,000 miles before it requires extensive reconditioning. The average life of a valve is about 450,000 miles.

With the exception of an occasional cleaning and renewal of the check valve compression spring, needle valve, and spray tip, the life of a fuel injector is well over 2,000,000 miles.

The recently acquired high-speed road locomotives are rated at 4000 h.p. each, and consist of four 1000 h.p. two-cycle 12-cylinder V-type engines, having an 8½-inch bore and 10-inch stroke. The starting speed is 75 to 100 r.p.m., idling speed 280 r.p.m. and the rated speed 800 r.p.m. The ready-to-run weight of locomotive is 626,000 lbs., or 156.5 lbs. per horsepower. Weight of one 12-cylinder engine is 25,000 lbs., or 25 lbs. per horsepower. The center of gravity of locomotive is 62 inches above the top of the rail.



A 4000-horsepower Diesel-electric locomotive in heavy passenger service, made up of two 2000-h.p. units

Fuel Oil Consumption

The fuel oil consumption of the 3000 h.p. Denver Zephyrs pulling 10 lightweight stainless steel cars has averaged about 1.82 gals. per train mile or .55 miles per gal. Therefore, the total fuel consumption for the 2073 miles round trip between Chicago and Denver is 3771 gals. which at 4½c per gallon cost $169.69 or 8.2 cents per train mile. The total average fuel consumption on these trains for the year around is distributed as follows:

Main power plants	82.33%
Heating boilers	13.70%
Auxiliary power for air conditioning, lighting, and so forth	3.97%

The cost of fuel and water for a steam locomotive handling a conventional train over this same route amounts to 20.2c per train mile, about two and a half times as much as for Diesel power.

The two factors which affect high speed are the size of the power plant and the weight of the equipment; almost every expense of rail operation is directly proportionate to weight. The ratio of train weight to horsepower should permit rapid acceleration, and the rate of acceleration should average from .18 to .24 of a mile per hour per second from the start until a speed of 90 miles per hour is attained in order to produce a performance consistent with satisfactory high speed operation. The greatest obstacles to any train are the grades encountered. For every one % grade the total tonnage of a train must be multiplied by 20 lbs., and this added weight which we call grade resistance must be multiplied by 20 lbs., and this added weight which we call grade resistance must be counteracted by the tractive effort of the locomotive.

All Burlington streamline equipment is of stainless steel construction. This material is known as 18-8, an alloy of low carbon steel with 18% chrome and 8% nickel. Incidentally it is not a new metal, having been discovered by Krupp many years ago. It was found to be noncorrosive and impervious to most chemicals, and so had unlimited possibilities for weight reduction and increased structural strength. The problem was how to fabricate this metal. Ordinary welding methods would destroy its valuable properties. Riveting was known to weaken any material and make it susceptible to shearing. Spot welding was tried, but the application of uncontrolled heat caused carbide precipitation around the weld and made this area subject to corrosion. Yet it did not require time to generate heat; it could be generated instantly and could be timed and con-

trolled. Consequently a method was devised for passing electric current through two pieces of metal so quickly that it did not injure the metal but did give enough heat to make a good weld. Thus the problem of fabricating stainless steel was solved.

This was the genesis of what is now known as the "Shotweld" process. The precision "Shotweld" machine that has now been developed controls the time, the current, and the pressure necessary for each weld so that welds made in this way have proved to be tougher than the virgin metal.

The tensile strength per square inch at 70° F. is 55,000 lbs. for aluminum, 60,000 lbs. for mild steel, and 150,000 lbs. for stainless steel. Stainless steel may fold and crinkle under tremendous pressure, but the welds hold. Because of its unusual elasticity, stainless steel will return to its normal shape after almost unbelievable deformation.

It may be interesting to bring out a few facts about the accident to the "Pioneer Zephyr" at Napier, Mo., in 1939, and to study the results of the tremendous impact sustained by this train. The phenomenal strength of stainless steel must be given credit for the saving of many lives in this accident. This train was traveling 55 miles per hour when it ran head-on into a freight locomotive with brakes set and coupled to two loaded freight cars. Although the total weight of this inert mass was approximately 350 tons, it was knocked 90 feet backwards. The amazing fact was that of the two score passengers, not a single person was seriously injured. Only one window in the coaches was broken out, and every door could be operated with no evidence of binding. The power car took most of the impact, yet with the exception of the front half, it withstood the collision with amazing resistance and was immediately rebuilt and returned to service.

The development of the disc brake for high speed service has constituted a radical departure from the conventional type of braking. This new brake consists of a disc and a pair of shoes, one of which bears against each face of the disc. A disc with its brake shoe combination is mounted against the inside hub face of each wheel. In addition to the regular features of the air brake equipment, this installation insures the highest practicable rate of retardation and affords protection against wheel sliding. A Decelostat on each non-power axle in the train and a Decelostat valve installed on each truck operate to check the progress of incipient wheel sliding.

Brake Shoe Out of Place

In the conventional type of braking with the shoe applied to the tread of the wheel, extreme temperatures cause the surface of the shoe to become molten. This subjects the tread to severe punishment and results in thermal checks and shelling. Within the last year over 25 light weight stainless steel cars have been purchased and equipped with disc brakes. Thermal checking and shelling of the wheel tread has been entirely eliminated on these cars. The brake shoe has no rightful place on the tread of a wheel in high speed braking owing to its damaging effects, and there is no doubt that disc braking is a long step in the right direction.

Considerable preliminary preparations are necessary before the purchase of Diesel equipment is actually consummated. The front end of the locomotives and the rear ends of the last cars in our trains are now designed according to standard streamlining practice. There are deviations in car construction, however, such as flush diaphragms between cars and flush windows and truck shrouds that either add or detract from the effects of streamlining and therefore call for a modification of the air resistance formula. Furthermore, we must know whether the energy for air conditioning and lighting is to come from axle-driven generators or from head-end auxiliary power. The present trend is to favor the former source of energy as it offers a more flexible arrangement when picking up or dropping out cars at connecting points. The axle-driven set, however, absorbs energy produced by the prime mover amounting to approximately 46 h.p. per car at the rail. Therefore all these factors must be determined before the correct amount of power can be calculated to handle the train involved on the predetermined schedule.

How Speeds Are Determined

Having all this information in hand, the train and locomotive resistances are calculated for various increments of speed. Train resistances are divided into 3 components. Journal resistance, as the name implies, represents the friction set up in the journals. Flange resistance is that resistance set up between the wheel flanges and the rail. Air resistance, of course, depends largely upon the design or shape of the train, and the motive to reduce this resistance naturally led to the development of streamlining.

A Yellowstone Park naturalist tells how the osprey, after capturing a fish and flying to its nest, will often catch the fish either broad-side or tail first. In that case the osprey will drop the fish and catch it again in mid-air so as to carry it head first. The osprey knows the advantage of streamlining by instinct, something which took us a long time to learn.

As the train speed increases, the train resistance also increases, but the tractive effort of the locomotive decreases so that when the combined resistances are equal to the tractive effort, the locomotive handling this train has reached its balanced or top speed.

The rate of acceleration in miles per hour per second is calculated for each uniform increment of speed, and the time in seconds necessary to accelerate from one increment of speed to the other is recorded so that, when the balanced speed is reached, an acceleration curve is developed which shows the total time consumed. This acceleration curve represents the true performance of the locomotive with the train involved, since it incorporates all the fundamental factors enumerated above. This curve is the basis of the "Speed Time" chart which, when completed, will show the time in seconds required to reach each point as well as the total time required between terminals. All of our high speed schedules have been prepared far in advance of delivery of the equipment, and they still stand today with only slight variations. These schedules are based upon an average load factor of about 75%, and calculations develop that the traction fuel consumption ratio for the Denver Zephyr consumes 35% of the total for propelling the locomotive and 65% for pulling the consist.

Essentials in Transportation

Safety and comfort are essentials in transportation and in establishing these high average speeds between terminals the one thought in mind was to make these schedules with the lowest possible maximum speed. To obtain a relatively high average speed with a reasonable maximum speed requires an analysis of the causes of interruption in operation. Such an analysis may lead to improvements in track alignment and signalling, reduction of curves, more gradual turnouts and crossovers, and more careful attention to the details of right-of-way maintenance so as to reduce slow orders which are disastrous to a fast schedule. These are important requisites to attaining a high average speed without high speed peaks. Villages commonly impose speed restrictions over street crossings. Separation by elevation or relocation is necessary if the restriction is to be avoided.

Curvature of track is one outstanding limitation to high speed. On a 3-degree curve, with proper spirals and adequate elevation, the comfortable speed is about 65 miles per hour. Therefore, in high speed main line operation, curvature should be held to a maximum of 1 degree or 1 degree 30 minutes. Take as an example the 10-car, 3000 h.p. Denver Zephyr trains. The acceleration curve developed for this train shows that its balanced speed is 98 miles per hour on level tangent track. It will take 18 minutes to attain this speed and a distance of 24.86 miles. In approaching a 3-degree curve the speed must be reduced to 65 miles per hour. After clearing this curve it will take 15 minutes and a distance of 22.42 miles to reach again the top balanced speed of 98 miles per hour. If it were possible to continue at 98 miles per hour in this zone, the 22.42 miles required to accelerate back to balanced speed would have been made in 13½ minutes, so that this 3-degree curve

was responsible for a loss of 1½ minutes. In time this does not seem a great deal, but in distance it is equal to about 2½ miles, for at 98 miles per hour every mile is covered in 36.73 seconds.

As the speed increases, the air resistance increases in proportion to the square of the velocity. In order to determine the power requirements at speeds in excess of 100 miles per hour, the writer recently completed a study involving a speed of 130 miles per hour. Hauling one observation-lounge and one coach, a 4000 h.p. locomotive would accelerate these 2 cars up to 130 miles per hour in 10 minutes 20 seconds and over a distance of 17.02 miles.

In these high speed studies we have learned to give due consideration to seconds. They do not mean much so far as time goes but have considerable value in terms of distance because at 130 miles per hour, a mile is covered in 27.7 seconds. Such a speed is probable with the modern equipment available today, but the limiting factor is that there are not many stretches of tangent track available on most railroads to make this higher speed practical. Furthermore, there is a differential of only 8.3 seconds per mile between 100 and 130 miles per hour so that, as far as the matter of time is concerned in a 100-mile stretch, a train traveling at 130 miles per hour would gain only 14 minutes over one going 100 miles per hour. Also, the cost to reduce curvature and eliminate restrictions to make the higher speed possible would be very expensive.

In bringing the subject of streamline trains to conclusion, one may say that never before in the history of railway transportation has equipment been finer than now. This gratifying development is due to the concentrated efforts of scientific research, the creative ability of the manufacturer, and the vision of progressive railway managements which had the practical wisdom to realize just what the public demanded before they would return to railway travel.

Diesels for Switching

The Diesel-electric has also made great progress in yard switching service, a service far less pretentious than that offered by the ultra streamline trains, but nevertheless where the Diesel is able to show the greatest return on its investment. On the Burlington System today we operate 55 Diesel-electric switchers, ranging from 360 to 1000 h.p. and totaling 40,100 h.p. A very attractive saving in operation is made when entire yards are Dieselized, such as at Western Avenue (Chicago), Dayton's Bluff (St. Paul), and Omaha-Council Bluffs, at which points there are 26 Diesel-electric switching locomotives in daily service.

The 600 h.p. units consume about 5 gal. of fuel oil per hour and the 1000 h.p. locomotive 7 gals. per hour, with a fuel supply sufficient for at least 50 hours of continuous operation.

The majority of our Diesel switching locomotives are assigned to continuous service wherever possible, 24 hours per day, 7 days a week, except that every seventh day they are taken out of service one 8-hour trick for inspection and adjustments. This high availability, together with the elimination of any standby losses, elevates this class of motive power to a position where it produces its greatest saving to the railroad. It performs economical and efficient service, working twenty 8-hour tricks per week at an average cost of about $2.29 per hour and offering availability ranging between 96 and 100%.

Several years ago a 5400 h.p. Diesel-electric locomotive designed for freight service was placed on test on various roads interested in its possibilities. This was indeed a bold challenge in a field where the steam locomotive was and still is in its most favored position. The top speed of the Diesel was comparable with that of the modern steam freight locomotive, but the characteristics peculiar to the Diesel-electric permitted the latter to maintain a higher average speed. The Burlington had the privilege of testing this locomotive in main line freight service between Chicago, Kansas City, Denver, and St. Paul. The performance was remarkable because of the engine's extremely high tractive effort. The power plant consisted of four V-type engines each developing 1350 h.p. and each having 16 cylinders with 8½ in. bore, 10 in. stroke. Sixteen traction motors directly geared to 16 axles produced a draw-bar pull of 226,000 lbs. compared to a draw-bar pull of 83,300 lbs. produced by the average heavy type steam freight locomotive. The total ready-to-run weight was 454 tons.

We left Chicago yards in this locomotive one morning bound for Denver with 102 cars and, after leaving Lincoln, Nebr., started the mile high climb. The rise is gradual at first but the grades become more abrupt; there is a climb of 2200 feet between McCook, Nebr. and Akron, Colo., a distance of 145 miles. We arrived at Denver at 1:57 a.m. on the second morning, and after the refueling and general inspection was completed, we again departed for Chicago at 4:04 a.m., only 2 hours and 7 minutes after arrival.

Experimental Runs

This round trip covered 2020 miles. The locomotive handled 8,372,366 gross ton miles and was in actual operation on the road 53.63 hours at an average speed of 37.74 miles per hour. It consumed 6.47 gals. of fuel oil per mile and a total of 20 gals. of lubricating oil.

This locomotive was equipped with a load control in the electrical circuit, and when the throttle was advanced, additional current was generated until there was sufficient energy to move the load. The throttle was opened to the first po-

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sition, and when the train did not move, the operator advanced the throttle into the second position and so on until enough electrical energy was created to move the train. Sometimes it was necessary to move the throttle into the sixth of the eight throttle positions.

During our test 6 coupler knuckles were broken and 4 draw-bars pulled despite careful handling by experienced road foremen. If the throttle and air brakes had not been carefully manipulated, it would have been possible to pull a draw-bar at almost any time.

One morning at Creston, Ia., on the eastbound trip we came to a stop on a heavy grade with 88 cars, 4202 tons, stretched out. Without taking slack, we proceeded to start the train, and this was one occasion when it was necessary to open the throttle to the sixth position. We carried a dynamometer car behind the locomotive on all these tests, and on this occasion it finally recorded 195,000 lbs. pull before the train moved, at which time it broke into three sections because of the failure of a knuckle at one point and the pulling of a draw-bar at another. No doubt the limiting factor of this unit was the capacity of the draft rigging of the rolling stock.

On one occasion the dynamometer recorded a 215,000 lb. draw-bar pull. Usually when there was a registration in excess of 175,000 lbs., a coupler somewhere in the train would fail. The locomotive, however, showed a remarkably high rail adhesion, for in all these tests it was quite difficult to slip the wheels.

Speed Often Hit 60 M.P.H.

On one of the trips between Kansas City and Chicago we picked up 109 loads, 6756 tons, at Galesburg. We departed from Galesburg at 7:47 p.m. and, making one stop, arrived at the Chicago yards, a distance of about 156 miles, at 11:56 p.m. A total of 1,050,288 gross ton miles were handled in 3 hours 57½ minutes at an average speed of 39.23 miles per hour; fuel consumption was 7.78 gals. per mile.

For great distances during this trip, our speed exceeded 60 miles per hour and, while we rode in the quiet cab of this locomotive, we could not refrain from marveling at the apparent ease with which such enormous power was being developed. Here was a real challenge in a new field of service.

Only time will tell what progress the Diesel will make in this class of service. During its development, many difficult obstacles have arisen, some so great that at times they seemed insurmountable. But always, one by one, they were eliminated, and in a short span of 9 years the Diesel has steadily forged forward.

After an important development has passed the embryonic stage and finally presents its usefulness to a waiting world, it must prove its practicability as being something better and something that can perform a duty in a more efficient and more economical way than its predecessor. Unless it can prove this it will automatically perish.

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Combustion Processes Interpreted By Six Prominent Scientists

In view of the current trend toward higher antiknock values for aviation gasoline and higher knock ratings for motor fuel gasolines in postwar days, the publication is timely of "The Chemical Background for Engine Research", Vol. II in the Frontiers of Chemistry series published under the auspices of Western Reserve University of Cleveland. The book is a compilation of 12 lectures, by six authorities in the field of combustion research, which were presented in person in a special short course at the university. It is edited by R. E. Burk, director of research for Standard Oil Co. of Ohio, Cleveland, and Oliver Grummitt, of Morley Chemistry Laboratory, of the university.

For the industrial research worker and the student of developments in motor fuels and the means for testing them in laboratory engines, the book presents valuable data. Included is a history of combustion research; the principles of chemical thermodynamics; chemistry of hydrocarbons as related to their fuel characteristics; and the experimental side of combustion research engines, among other topics.

Of the most popular interest perhaps is the discussion of chemical agents as knock promoters and knock suppressors, in the chapter entitled, "The Experimental Side of Combustion Research in Engines," by Maj. Bernard Lewis, formerly senior physical chemist of the U. S. Bureau of Mines, now Chief of the Explosives and Loading Division for the Pittsburgh Ordnance District. Knock suppressors are described in the light of the theory that the action of an antiknock compound consists in the destruction of peroxides in the fuel charge formed during combustion.

"Of the thousands of compounds that have been investigated for their antiknock properties, lead tetraethyl, discovered by Midgley and Boyd in 1922, is the most effective," it is stated. "Iron carbonyl is less than half as effective, mol for mol. To prevent the deposit of lead or lead oxide in the engine ethylene bromide is added to the Pb $(Et)_4$ (ethyl fluid), the volatile $PbBr_2$ being removed in the exhaust. It has already been mentioned that the compound responsible for the suppression of knock is not Pb $(Et)_4$, but its decomposition product, Pb, which, with its oxide, can undergo oxidation and reduction and so continually take part in the inhibiting reactions.

"Potassium and thallium are able to undergo several stages of oxidation and should be good anti-knocks; thallium has been found to have about 11 times and potassium about 4 times the anti-knock value of Pb $(Et)_4$ on a weight basis. All compounds that inhibit the slow oxidation of hydrocarbons are more or less effective as anti-knocks. (Table I)

"Anti-knock compounds containing nitrogen are in a special class. Their anti-knock value varies manifold with the type of compound (note m-xylidine = 1.4 and triphenylamine = 0.09). The most effective exert a measurable effect at concentrations as low as 0.1% and as such can be considered true anti-knock compounds. Their effectiveness is not due to the presence of nitrogen, since it is well known that some nitrogen compounds are pro-knocks (nitrites, etc.), but rather to a special type of linkage between nitrogen and the organic radical. Those having no aromatic linkage to the nitrogen are least effective, whereas the most effective contain at least one such linkage and an N-H linkage, indicating a relation of the anti-knock action to oxidation and reduction of the nitrogen to which these compounds are particularly susceptible."

Other contributors to *"The Chemical Background for Engine Research"* include: Ernest F. Fiock, Senior Physicist in the Automotive Power Plants Section of the National Bureau of Standards, with "A Survey of Combustion Research"; Frederick D. Rossini, Chief of the Section on Thermochemistry and Petroleum Chemistry of the Bureau of Standards, with "Chemical Thermodynamics of Hydrocarbons"; Frank C. Whitmore, Dean of the School of Chemistry and Physics at Pennsylvania State College, with "Synthetic Methods for Hydrocarbons"; Guenther von Elbe, Pittsburgh, Bureau of Mines staff, with "Kinetics of Flame and Combustion"; and Otto Beeck, Associate Director of Research, Shell Development Co. laboratories, Emeryville, Cal., with "Some Physiochemical Aspects of Lubrication."

The book sells for $3.50 and can be purchased through the Book Department of NATIONAL PETROLEUM NEWS, 1213 W. Third St., Cleveland, O.

Table I

Relative Effectiveness of Anti-knock Compounds and Some Anti-knock Fuels (Based on Aniline = 1) (Calingaert)

Benzine	0.085
Iso-octane (2, 2, 4-trimethylpentane)	0.085
Triphenylamine	0.090
Ethyl alcohol	0.104
Xylene	0.142
Dimethyl aniline	0.21
Diethylamine	0.495
Aniline	1.00
Ethyl iodide	1.09
Toluidine	1.22
Cadmium dimethyl	1.24
m-Xylidine	1.40
Triphenylarsine	1.60
Titanium tetrachloride	3.2
Tin tetraethyl	4.0
Stannic chloride	4.1
Diethyl selenide	6.9
Bismuth triethyl	23.8
Diethyl telluride	26.6
Nickel carbonyl	35
Iron carbonyl	50
Lead tetraethyl	118

Encyclopedia of Synthetics

"Era of Substitutes and Synthetics" is a reference book of approximately 400 pages defining under their trade name and giving some of the properties of numerous new synthetic materials and products, many of which have been provided as substitutes for wartime critical materials. Limited space is given to describing by types the new products, as synthetic rubbers and plastics, for example. Some classifications of products in which the petroleum industry is particularly interested, such as solvents and rust preventives, are omitted. The book is edited by Morris Schoengold. It sells for $10 and can be purchased through the Book Department of NATIONAL PETROLEUM NEWS, 1213 W. Third St., Cleveland, O.

Second Edition on NE Steels

Metallurgists and design engineers with refining companies will discover helpful information on the National Emergency steels in the booklet under that title issued by Republic Steel Corp. While very limited application for these alternate steels as yet has been found in oil company plants, this field of their usefulness may be broadened with experience. The book of 75 pages, which is a second edition includes a description and interpretation of the end quench hardenability test, which is being used by steel manufacturers as an indication of certain performance characteristics of their products and for this reason will become better known by steel consumers. The book can be secured from the company's headquarters in Cleveland.

Alloys for Condenser Tubes

Requirements for condenser and heat exchanger tubes for refinery units designed for the manufacture of the new petroleum products such as butadiene, toluene and high octane gasoline are discussed in the Condenser Tube Manual of Bridgeport Brass Co. Suitable alloys are given and duplex tubing, developed to withstand 2 different types of corrosive attack existing on both sides of a tube, is described. The company's research work in the various types of corrosion also is described. Conditions were included such as are experienced in petroleum refineries. The booklet of around 120 pages is available by writing the company.

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